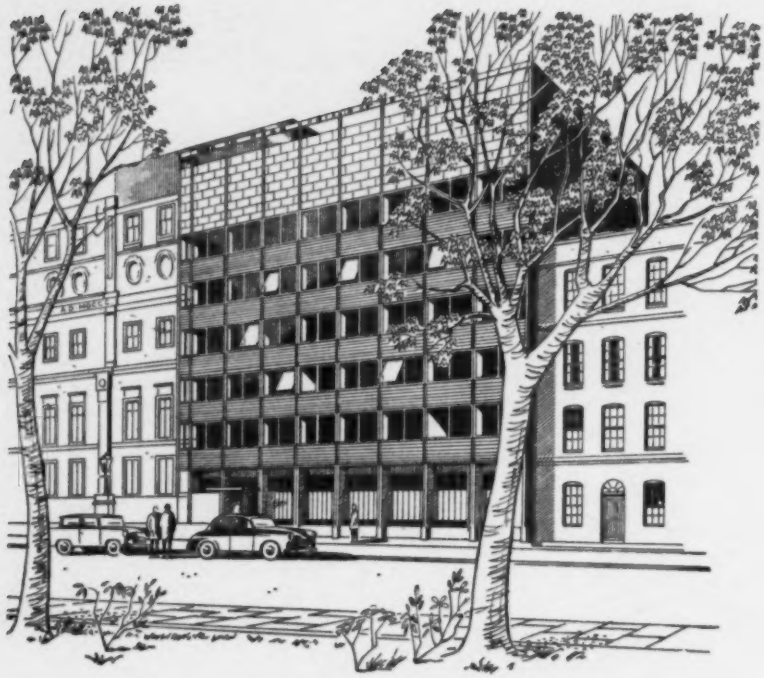
ANNALS OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND

VOLUME 27 AUGUST 1960 No. 2



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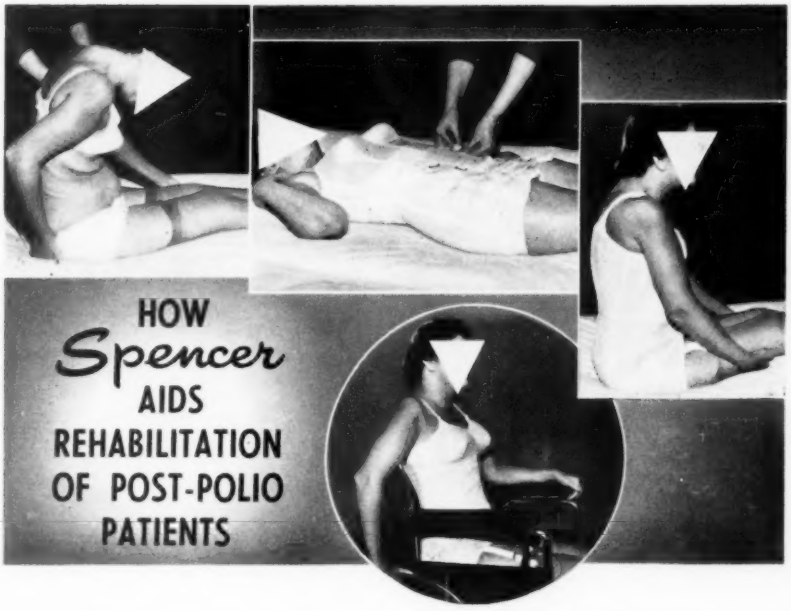

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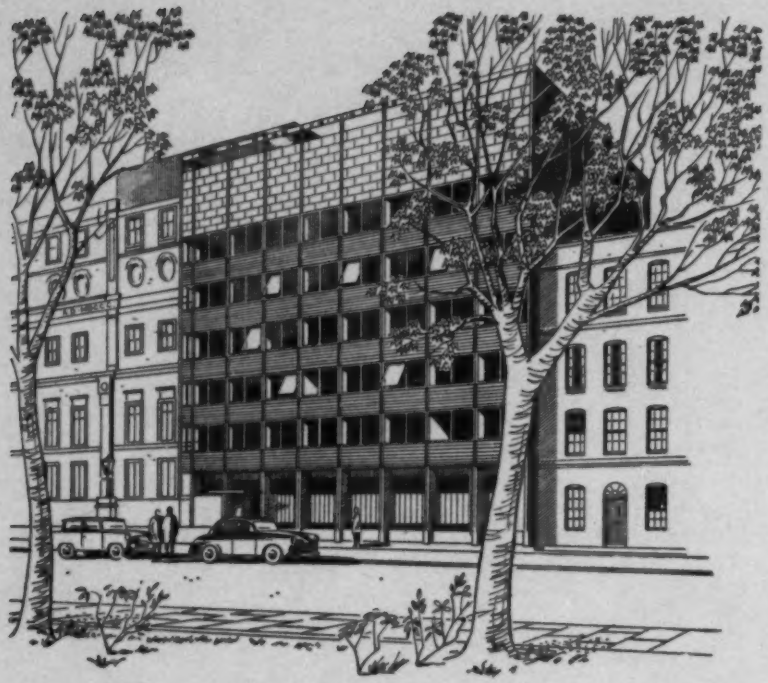

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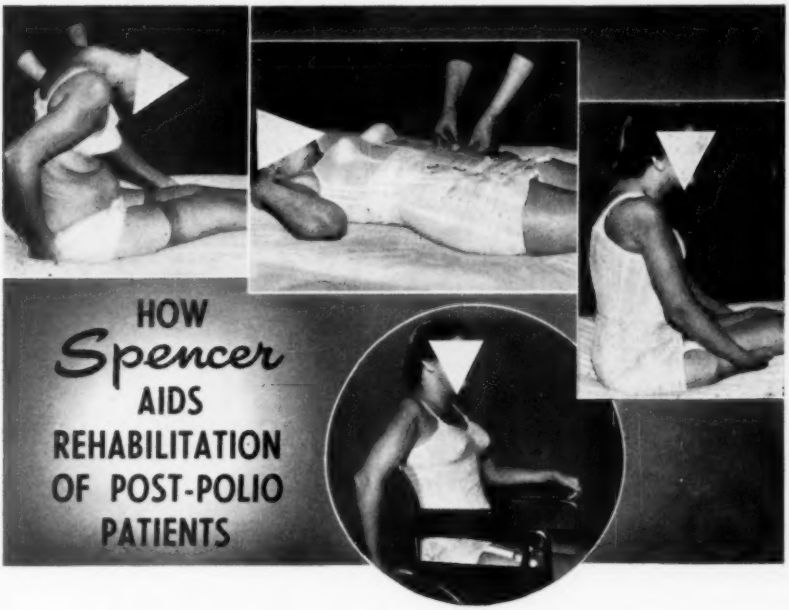

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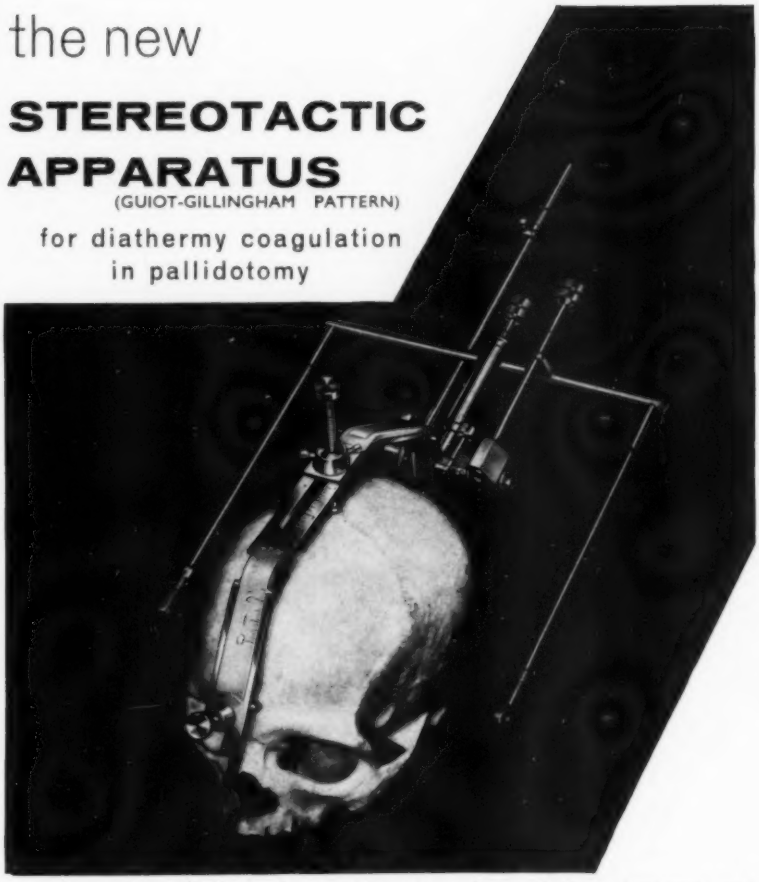

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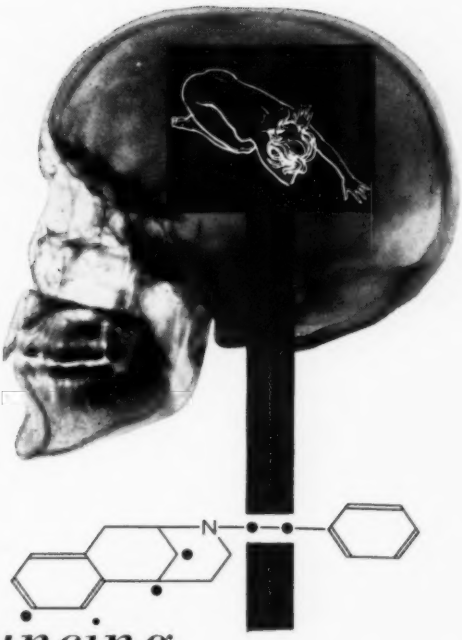

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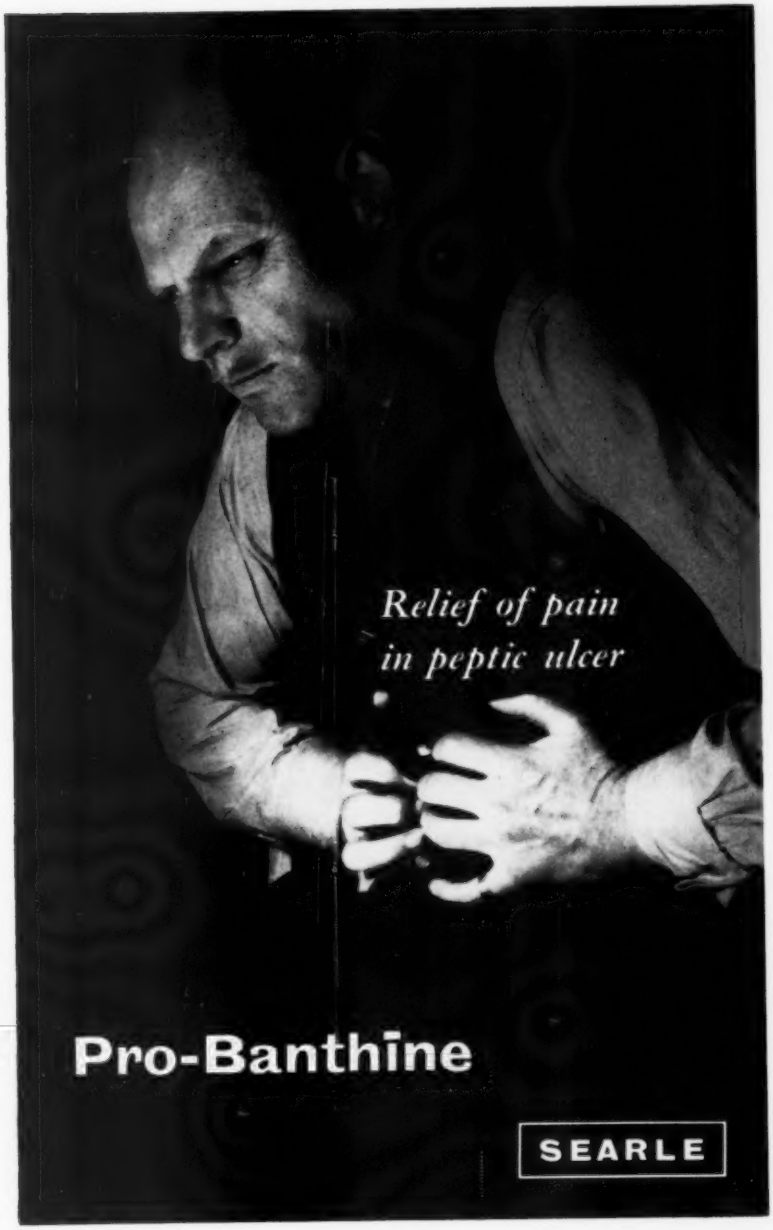
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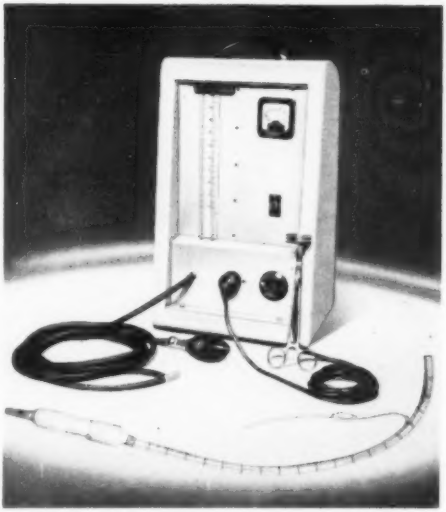

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Volume 27 AUGUST 1960 No. 2

Published by
THE ROYAL COLLEGE OF SURGEONS OF ENGLAND
LINCOLN'S INN FIELDS LONDON, W.C.2

Annual Subscription - *£2 post free*
Single copies - - *3s. 6d. post free*

ANNALS OF
THE ROYAL COLLEGE OF SURGEONS OF ENGLAND

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GORDON-WATSON AND ST. MARK'S

Gordon-Watson Lecture delivered at the Royal College of Surgeons of England

on

8th October 1959

by

L. E. C. Norbury, O.B.E., F.R.C.S.

Consultant Surgeon, Royal Free Hospital, St. Mark's Hospital, West Middlesex Hospital and the Belgrave Hospital for Children

IT IS INDEED a great compliment to have been asked to deliver the first Gordon-Watson Memorial Lecture instituted in this College. I am deeply conscious of this honour, more especially because the name which we commemorate to-day conjures up in my mind a true friend and colleague with attributes of a kindly and courteous gentleman, an enthusiast, sportsman, soldier, a bold and courageous surgeon and a pioneer in certain fields of research. I have a difficult task to do justice to my subject and adequately to portray qualities both social and professional.

I was a colleague of Gordon-Watson (Fig. 1) on the staff of St. Mark's Hospital for a period of nineteen years and had the privilege of enjoying his friendship. He was appointed to the staff in 1908 and was a member of the active staff until 1931. I joined the staff in 1912, and was a member of the Council of this College with Gordon-Watson from 1938 to 1940, when he retired from the Council, so the substance of my lecture is, to a large extent, based on personal knowledge.

Fig. 1. Sir Charles Gordon-Watson.

Charles Gordon-Watson was born on April 18th 1874, the eighth child and fifth son of the Rev. Henry George Watson, M.A., Vicar of St. Leonard's, Bucks., and his wife, née Gillman. Religion played an important part in his upbringing and throughout his life. He was brought up as a member of the Church of England, but joined the Roman Catholic Church whilst a young man. He was educated at St. Mark's, Windsor, and at St. Bartholomew's Medical College and Hospital, qualifying with the Conjoint Diploma in 1898.

Soon after qualification he served for six months as house-surgeon at the Norfolk and Norwich Hospital and was subsequently appointed house-surgeon to Howard Marsh and Lockwood at St. Bartholomew's. Towards the end of his year's appointment, he volunteered to serve as a Civil Surgeon in the South African War, which he did from 1899 to 1901 at the Duke of Portland's Hospital in the vicinity of Cape Town, where he was associated with Anthony Bowlby, who was Surgeon in charge and whom he had left as Assistant Surgeon at St. Bartholomew's; and also with Cuthbert Wallace from St. Thomas's. Both Bowlby and Wallace served in the first world war as Consultants; each received a Knighthood and at a later date each became President of this College, Sir Anthony Bowlby from 1920 to 1922, and Sir Cuthbert Wallace from 1935 to 1937. Gordon-Watson was awarded the Campaign Medal with three clasps for his services in South Africa.

He became a Fellow of this College in 1902 and was appointed the same year to the staff of the Metropolitan Hospital, where he became President of the Aesculapian Society.

I should mention that previous to qualification he had enlisted in the Volunteers and on his return from the Boer War in 1901 he was commissioned as Surgeon to the 3rd Middlesex Royal Garrison Artillery Volunteers, transferring to the Territorial Army as Captain, R.A.M.C., on its formation in 1908, the same year in which he was appointed to the staff of St. Mark's Hospital.

In 1910 he was elected assistant surgeon to St. Bartholomew's Hospital and served with Howard Marsh. He retired from the active staff of the Metropolitan Hospital in 1913, and was appointed a consulting surgeon the same year. He also served as consultant to St. Andrew's Hospital, Dollis Hill, for many years.

When war broke out in 1914 he was posted to the Duchess of Westminster's Hospital at Le Touquet. Later, as a Colonel in the Army Medical Service, he became consulting surgeon to the Second Army in France, and afterwards to the British Force in Italy.

In 1914 Gordon-Watson was the first to recognize the syndrome of " trench frost-bite " and was a staunch advocate of the use of " Bip "

(a mixture of Bismuth, Iodoform and Petrolatum) as a dressing for wounds. He was four times mentioned in dispatches during the Great War, created a C.M.G. in January 1916 for military services in the Field, and in June 1919 a Knighthood of the Order of the British Empire was conferred upon him. In 1917 he had been made a Knight of the Order of St. John of Jerusalem.

Gordon-Watson was a keen member of the Bath, Garrick and other London clubs. During the South African War he, with the late Sir Francis Fremantle, originated the "South African Civil Surgeons' Dinner", which was held annually for many years.

In 1917, he married Alice Gwendoline Mary Teevan, who died in 1935. In 1920 he assumed the name of Charles Gordon Gordon-Watson by deed poll.

We are indeed honoured to-day by the presence of his son, Brigadier Michael Gordon-Watson, to whom I am greatly indebted for the opportunity and privilege of studying several albums kept by his father, as also three volumes of typescript entitled *Forty years in surgical harness*. These embody jottings from his case-books and numerous other items of interest, including introductory remarks prefacing each volume, from the years 1898 to 1936, which his son presented to St. Bartholomew's Hospital. By the courtesy of St. Bartholomew's I was able to obtain access to these most valuable and interesting documents and have drawn freely on the information they contain.

After the first world war, Gordon-Watson wrote a letter published in *The Times* of 1st November 1919. Amongst others he was aware of the need for a more comprehensive and better organized system of physical education of the populace from childhood upwards. He was concerned about the danger of a C3 population arising, especially at a time when the flower of our manhood had been cut off and we were endeavouring to reconstruct a new and better kingdom. Other names subscribed to this letter were Sir Anthony Bowlby, Sir George Makins, Lord Moynihan and Sir Frederick Treves.

On 11th October 1920, Gordon-Watson had the honour of presenting a Great Mace to the American College of Surgeons on behalf of the consulting surgeons of the Armies of Great Britain who took part in the 1914–1918 war. In the words of an illuminated address, which is amongst his papers: "The Regents of the American College of Surgeons accept the Mace as a token of the cordial relationship between the British Empire and the United States of America in those days of duty when the Surgeons of this country stood together in arms with the Consulting Surgeons of the Empire, fighting for the common cause of Truth, Liberty and Justice."

In 1931, about the time that he retired from the active staff of St. Mark's, Gordon-Watson was elected an Honorary Fellow of the American College of Surgeons. He was also elected an Honorary Member of the Inter-State Postgraduate Medical Society of North America in recognition of " benefactions to humanity ".

After the war, Gordon-Watson became full surgeon at St. Bartholomew's. He retired from the active staff in 1934 and was elected an Honorary Consulting Surgeon and a Governor of the Hospital.

Sir Charles was a member of the Council of the College from 1924 to 1932. He was re-elected in 1933, after an interval of one year, and on this occasion headed the poll. He was Vice-President from 1935 to 1937, with Arthur Burgess as his co-Vice-President for the first year and Victor Bonney during his second year of office. In 1940 he resigned from the Council at the end of his seventh year in office, having served for a term of 15 years in all.

For many years he was Treasurer of the Medical Protection Society. He practised at 82 Harley Street until his appointment as Consulting Surgeon to the Army at Home in 1939 led to his settling in York with the rank of Major-General. Here he continued to live after relinquishing his appointment in 1942.

Gordon-Watson possessed a somewhat commanding appearance which was, however, tempered by a delightful and ready smile. He described himself as an " incorrigible Tory ". His untiring energy and capacity for friendship made him an outstanding figure among his fellows. His enthusiasm was phenomenal. As a young man he was a pioneer among motor cyclists and took part in racing at a time when machines were precarious and not at all permanent.

He was a keen golfer and a most energetic tennis player. He played soccer as a student, but in later years his interest turned to watching rugger. He was a good horseman and became an ardent supporter of horse-racing, which led to his appointment of Consulting Surgeon to the Jockey Club and the National Hunt Committee. Shooting and fishing took him to Scotland and Norway. He was also greatly interested in drama: he himself was an amateur actor of no mean standard, and amongst other attributes he was a connoisseur of wine and a lover of dogs.

Gordon-Watson was in essence a general surgeon. When appointed Assistant Surgeon to St. Bartholomew's in 1910, he was attracted to orthopaedics and was closely associated with Howard Marsh. He had a bent towards traumatic surgery in the days before all fractures automatically passed into the hand of the orthopaedic surgeon, and he was an early

advocate of the Balkan Beam. He will perhaps be best remembered for the contributions he made to the science and art of proctology in association with St. Mark's Hospital, to which he was appointed Surgeon in 1908.

St. Mark's has had close associations with St. Bartholomew's ever since it was founded in 1835 by a Bart's man, Frederick Salmon (Fig. 2), in Aldersgate Street, and was subsequently established on its present site in the City Road in 1854. A perusal of the list of surgical staff of the hospital reveals that it was not uncommon for a Bart's man to be appointed

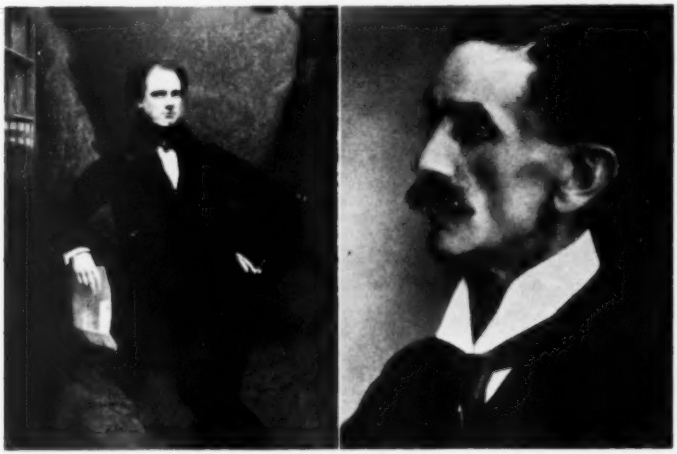


Fig. 2. (*a*) Frederick Salmon. (*b*) Percy Furnival.

to St. Mark's. For example, Percy Furnival (Fig. 2b), who was also on the staff of the Metropolitan Hospital; Swinford Edwards, a student and house-surgeon at Bart's, appointed to St. Mark's in 1884; Sir Frederick Wallis, whose vacancy I obtained at St. Mark's, entered St. Bartholomew's as a student in 1879. Like Gordon-Watson he was also surgeon to the Metropolitan Hospital.

Since Sir Charles's death the liaison between St. Bartholomew's and St. Mark's has been cemented by the good fortune of having Naunton Morgan as a member of the Consultant Staff of both hospitals. Morgan was house-surgeon at St. Mark's in 1926 and 1927, and filled the Staff vacancy when Gordon-Watson retired in 1931. This liaison has been further strengthened by the appointment of Ian Todd.

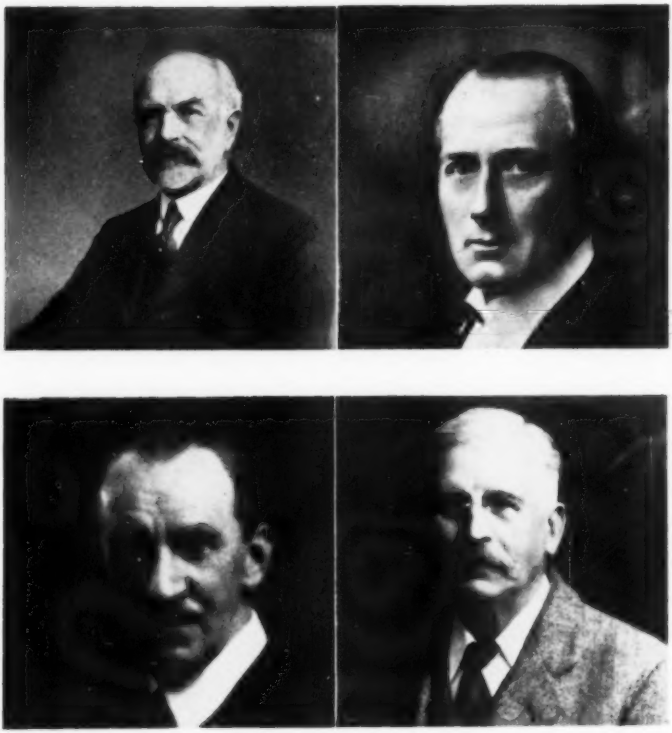
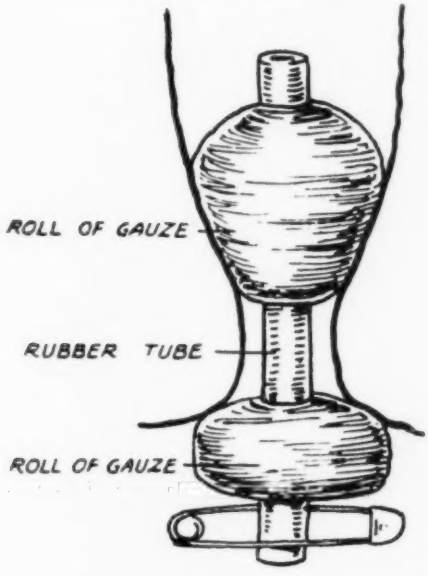


Fig. 3. (*a*) Frederick Swinford Edwards. (*b*) Sir Frederick Wallis. (*c*) J. P. Lockhart-Mummery (*d*) Aslett Baldwin.

Contemporaries of Gordon-Watson 1908–1931 *on Surgical Staff of St. Mark's Hospital* (*Fig.* 3)

Frederick Swinford-Edwards	1885–1913
Sir Frederick Wallis	1896–1912
J. P. Lockhart-Mummery	1903–1935
Aslett Baldwin	1908–1920
Henry Graeme Anderson	1912–1925
L. E. C. Norbury	1912–1946
W. B. Gabriel	1920–1959
E. T. C. Milligan	1925–1951
C. Naunton Morgan	House-surgeon in 1926 and 1927 Appointed to the Staff in 1931

Gordon-Watson was a staunch advocate, possibly one of the last, of removal of piles by the clamp and cautery method, in cases where not more than three piles were present and when the skin was not involved in the piles (Gask and Wilson, 1920). He regarded this method as most suitable



To illustrate the method of plugging the rectum for the arrest of hæmorrhage. (After Lockhart Mummery.)

Fig. 4.

for cases of gangrenous or thrombosed piles, when it was advisable to avoid a cutting operation owing to the danger of spreading sepsis. He found recovery to be rapid and pain tended to be less than after ligation or after Whitehead's operation. He used to refer to the cautery as his " fiery furnace ". He favoured treatment by carbolic acid injections for cases of uncomplicated piles when it was difficult for the patient to lie-up, and in certain cases where operation was contra-indicated. For cases of post-operative recurrent haemorrhage after removal of piles, he favoured the use of a method devised by his colleague, J. P. Lockart-Mummery (Fig. 4).

In a paper entitled *A demonstration with the sigmoidoscope* (1911), Gordon-Watson states that " the sacrum is the Pons Asinorum of sigmoidoscopy. Once the promontory is passed, progress is unimpeded." As regards methods of examination, he stressed the importance of the genu-pectoral position in males and the left lateral position in females.

He advocated the lithotomy position for operations and examinations under anaesthesia. He emphasized the necessity of a sigmoidoscopy in all cases where a carcinoma was suspected but could not be felt with the finger.

In 1935, in collaboration with Harold Dodd, Gordon-Watson published his well-known article entitled *Observations on fistula-in-ano in relation to perianal intramuscular glands with reports on three cases* (Fig. 5). In

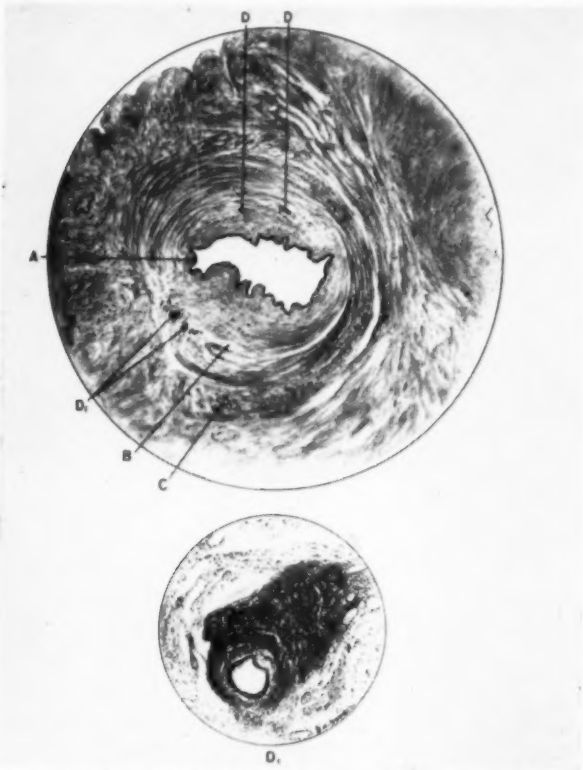


Fig. 5. Fistula-in-ano lined with glandular epithelium, as viewed through a sigmoidoscope.

1880 it had been pointed out by Hermann and Desfosses that some cases of fistula-in-ano might have originated in glands penetrating deeply from the lower rectal mucous membrane into the peri-anal tissues. Cuthbert Dukes had also reported the presence of intra-muscular glands in complete sections of the anal region, and suggested their possible association with fistula.

Gordon-Watson was an adept at removing large benign villous tumours of the rectum by an " extended Whitehead's operation " (1931a). His ingenuity is exemplified by the case of a man admitted to St. Mark's with a split soda-water bottle in his rectum, i.e. one with a short neck and smooth bulbous base. It had been inserted well inside the rectum with its open end uppermost so that the bulbous end distended the rectum. He found it impossible to get a grip on the bottle by ordinary means and so, under an anaesthetic, he applied forceps but could not get a grip of the smooth base. After ineffectual efforts a brilliant obstetrical idea struck him. He opened the abdomen and was able to perform version so that the open end of the bottle was now in the anal canal. It was then possible to insert one blade of the forceps inside the bottle and, with the other blade on its outside, a speedy delivery resulted.

In his typescript case-books of *Forty years in surgical harness*, which comprise eight chapters, Gordon-Watson divides these, for the most part, into groups of four years, and each group is prefaced by an illuminating quotation such as:

> *I hold every man a debtor to his profession, from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavour themselves by way of amends, to be a help and an ornament thereunto.* (*Francis Bacon.*)
>
> *Without an accurate acquaintance with the visible and tangible properties of things, our conceptions must be erroneous, our inferences fallacious and our operations unsuccessful.* (*Herbert Spencer.*)
>
> *Few men make themselves Master of the things they write or speak.* (*John Seldon.*)
>
> *If a doctor's life may not be a divine vocation, then no life is a vocation and nothing is divine.* (*Stephen Paget.*)

I thought it would be of interest to quote certain excerpts from Gordon-Watson's Bradshaw Lecture delivered in this College in 1937, depicting his views on the pathology and treatment of carcinoma of the rectum some 25 years ago. He stressed the fact (which was recognized by Cuthbert-Dukes and himself in 1930) that " no constant relationship exists between the extent of surface growth and the extent of deep infiltration ". Gordon-Watson also stressed the relationship of " adenoma with carcinoma " and the tendency of " familial Polyposis Intestini to undergo malignant transformation ".

He favoured a two-stage perineal excision, i.e. colostomy, followed by excision of the rectum by a perineal approach about ten days to a fortnight later, in all cases where the growth was below the peritoneal reflexion and was reasonably mobile.

For growths partly above and partly below the peritoneum, he was in favour of a similar line of procedure, provided that the growth was not advanced and after it had been ascertained by preliminary laparotomy

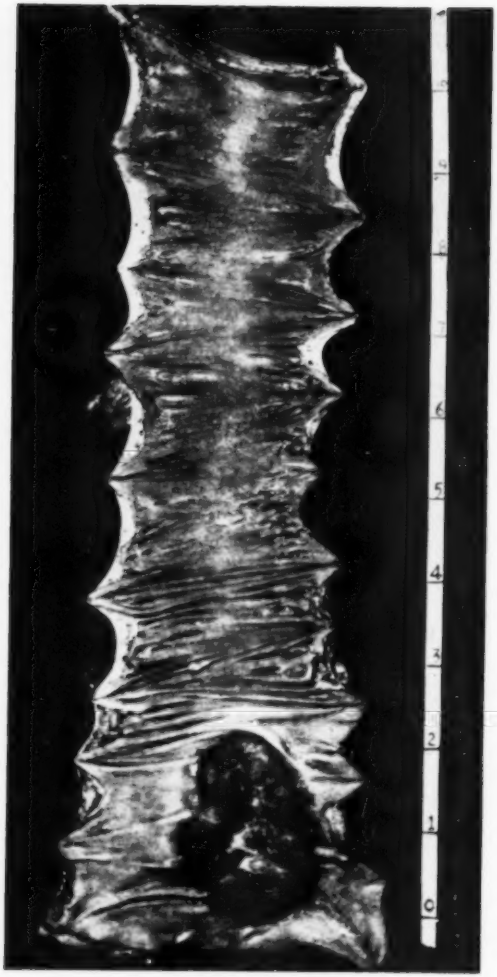


Fig. 6.

that there was no obvious lymphatic spread, and that the pelvic colon was long enough to allow of a high division from below. The length of bowel which Gordon-Watson was able to remove by the perineal route was often phenomenal. He agreed that in these cases a combined operation, either abdomino-perineal or perineo-abdominal is easier, and in some instances

more radical, but that the operative mortality was about double. (It should be noted that at this period such an operation was performed in two stages and so the actual resection of bowel was carried out in the presence of an already established colostomy, hence sepsis was common and peritonitis the main cause of the increased mortality.)

For an early growth entirely above the peritoneal reflexion and with a reasonable margin of bowel below the lesion, in his view there were no arguments based on sound pathology for removal of the rectum below the peritoneum. In such cases he favoured an abdominal resection by Hartmann's method, i.e. resection of the affected bowel with at least two clear inches below and as much bowel above the growth as considered advisable (Fig. 6), closure of the lower or rectal stump, and bringing out the upper divided end of bowel as a colostomy. He argued that this operation had quite a low operative mortality, with all the advantages that a combined operation gives of removal of lymphatics, along the inferior mesenteric vessels—takes less time and saves the patient the inconvenience of a large perineal wound. Gordon-Watson had performed this operation for many years with a low mortality. In his notes of 1933 he states that he would not perform the Hartmann operation if the growth was high enough to permit of a safe resection with anastomosis.

With regard to conservative methods, Gordon-Watson reported in his Bradshaw Lecture that Dukes and Lloyd Davies at St. Mark's had recently examined a series of 400 specimens removed by combined or perineal excision, and had proved by pathological examination that in about 50 per cent. of such cases the disease could have been eradicated as completely by a local resection as by total proctectomy. He argued that such knowledge should stimulate surgeons to reflect and open the door to a modified radical excision when conditions appear favourable.

This policy had been advocated by Grey-Turner, who, in his Murphy Oration in 1931, reported 14 cases of conservative resection of the rectum for malignant disease, 10 of which were alive and well for periods of from 3 to 11 years, with good natural function of the anal sphincters. I had the privilege of seeing a number of his cases thus treated.

In his lecture, Gordon-Watson makes no mention of a biopsy examination and grading of the tumour in its relation to treatment. He was in favour of a temporary preliminary colostomy, preferably in the transverse colon, as advocated by Devine, in cases of conservative resection. Risk of leakage at the subsequent anastomosis was thus diminished, also by the use of a rectal tube passed beyond the anastomosis line and left *in situ* for several days. He states that " radical operations as distinct from conservative methods have attained a high measure of efficiency, but will always remain tainted with the stigma of an artificial anus ". He observes that time is required to perfect and standardize conservative methods.

At the best they will only be suitable for cases of Grades A and B of Dukes' Classification, which at the present stage of diagnosis only account for about 50 per cent. of cases.

For growths in the region of the peritoneal reflexion there was a place for resection by the pull-through method, leaving the anal sphincters intact. This method was first described in this country in 1903 by Dame Louisa Aldrich-Blake. The bowel was mobilized from the abdomen, divided from the perineal aspect just above the sphincters and pulled through the anus, the affected portion removed and the cut end sutured to the anal skin.

Moulonguet's modification consisted of excision of the mucous membrane of the anal canal, prior to a pull-through and suture to the anal skin.

Gordon-Watson drew attention to the danger of implantation of cancer cells following conservative or restorative resection operations, the result of handling and pressure on the growth from without, before division of the bowel. He considered that this might determine an early recurrence at the anastomotic line. This observation has not been lost sight of, and at the present time, in cases of conservative or restorative resection, it is the practice at St. Mark's to wash out the rectum with a solution of perchloride of mercury prior to division of the bowel, and to wipe the cut ends with this solution before the actual anastomosis.

In the concluding passages of his Bradshaw Lecture, delivered nearly 23 years ago, Gordon-Watson paid a tribute to Sir James Paget, who, in his own Bradshaw Lecture delivered in 1882, made the following statement: " Better treatment will follow better diagnosis and better diagnosis will certainly follow a more exact pathology ". Gordon-Watson emphasized the truth of this dictum delivered by the " Father of Surgical Pathology ".

From 1928 to 1932, the operative mortality for two-stage perineal excision at St. Mark's (performed by all surgeons) was 5.9 per cent. During the same period the mortality for combined excision (abdomino-perineal or perineo-abdominal), which at this period was usually a two-stage operation, was as high as 30 per cent., hence the reluctance of the surgeon to embark on any form of combined excision. Sepsis with peritonitis was the main cause of the high mortality due to presence of an already established colostomy at the time of the abdominal resection.

It is interesting to compare the following figures which indicate the operative mortality at St. Mark's at the present time:

	per cent.
One-stage perineo-abdominal excision ..	2.0
Synchronous combined excision	4.1
Restorative intra-pelvic resection with rectal anastomosis	5.7

Previous to 1932 the standard operation at St. Mark's Hospital for carcinoma of the rectum was a two-stage perineal excision. An abdomino-perineal operation was occasionally performed for a high growth, but usually in two stages.

During the years 1928 to 1931, Gordon-Watson had under his care at St. Mark's 63 patients with carcinoma of the rectum, and two patients with carcinoma of the colon (Table I).

TABLE I

ANALYSIS OF TREATMENT OF 65 CASES OF CANCER OF LARGE BOWEL
by SIR CHARLES GORDON-WATSON
St. Mark's Hospital, 1928–1932

Growth not removed	
No treatment	1
Interstitial irradiation only (needles or seeds)	9
Colostomy only	23
Colostomy + interstitial irradiation	9
	42
Growth removed	
Local excision	3
Perineal excision, two stage	20
	23

If Sir Charles was with us to-day he would be thrilled with the advances in rectal surgery since his time at St. Mark's. He would be the first to join with his colleagues in congratulating Gabriel on attaining the low mortality rate of 2 per cent. for his perineo-abdominal operation, and Lloyd-Davis and Naunton Morgan, as well as other members of the Surgical Staff of St. Mark's, on the splendid results obtained from the synchronous combined operation, especially in cases of extensive and advanced growth. He would have a specially warm tribute ready for his colleague Naunton Morgan, who has obtained such excellent results from restorative excision in suitable cases, thus avoiding the stigma of an artifical anus, the goal at which Sir Charles aimed. He would have noted with great satisfaction and appreciation advances made by the anaesthetists in their all-important sphere of action as members of the surgical team.

Gordon-Watson was in the habit of employing certain gadgets when performing a perineal excision. One was a piece of wood, shaped like an egg, with a metal staple at one pole (Fig. 7a). The egg was inserted into the rectum before sewing up the anus, and was fixed in position by means of the staple. He found this of great assistance during separation of the rectum from surrounding structures, such as the urethra, prostate or vagina. A characteristic split in the rectal wall invariably followed the use of the egg (Fig. 7b), so that the pathologist had no trouble in diagnosing the name of the surgeon when the specimen reached the laboratory.

Another gadget was an " inflation bag " which was inserted into the perineal wound left after excision of the rectum, before partial closure. The bag had a tube and tap for inflation. When distended it gave support to the pelvic floor and controlled haemorrhage. For irrigation of the wound it was deflated and subsequently inflated.

In an article on *Progress in rectal surgery* (1934), Gordon-Watson pays a tribute to Frederick Salmon, the founder of St. Mark's Hospital. Salmon was a Bart's man who qualified three years after the battle of

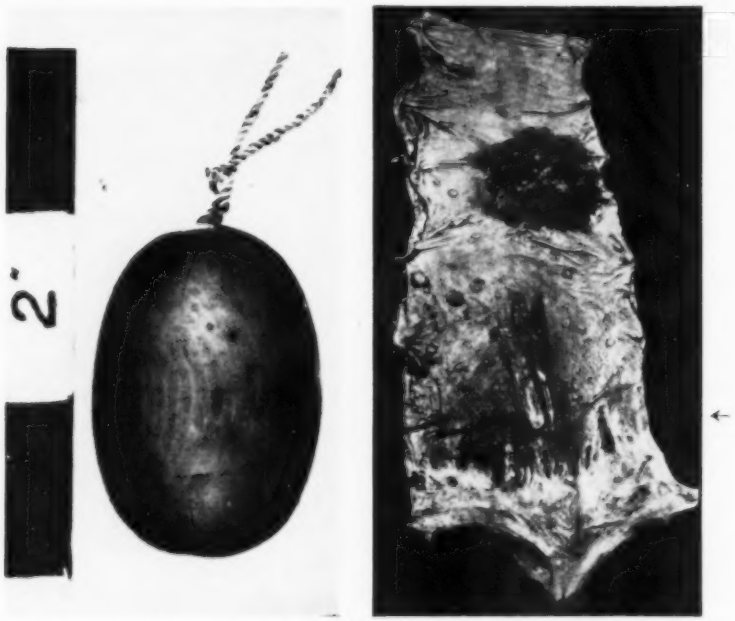


Fig. 7 (*a*) The " egg " used by Gordon-Watson when performing a perineal excision.

(*b*) Specimen showing the characteristic split in the rectal wall after the use of the " egg ".

Waterloo. In 1835 he founded an institute in Aldersgate Street, with seven beds, for the relief of " the Poor afflicted with Fistula and other diseases of the Rectum ", and with the Lord Mayor as its first President (since that date the Lord Mayor in office has automatically held this post). In 1838 the hospital was moved to Charterhouse Square and this allowed an increase in the number of beds to 14, also providing for a much larger out-patient department. In 1854 the hospital was removed to its present site, and was opened officially on St. Mark's Day, 25th April 1854.

Out of 131 cases admitted during the first year there were 34 cases of rectal stricture and 26 cases of piles. Nearly 100 years later, out of 885 admissions, there were 349 cases of haemorrhoids and only nine of non-malignant stricture. Gordon-Watson states that " in the progress of rectal surgery, with the elimination of sepsis, non-malignant stricture has become a comparatively rare complaint ".

Salmon was the pioneer of modern rectal surgery in England. His operation for haemorrhoids, known as the " Salmon operation ", is but little changed today. He was the first surgeon to combine ligature with excision and to settle the controversy at that time between ligature and excision.

In 1935 the Medical Committee of St. Mark's celebrated its Centenary by publishing a book containing the history of the Hospital: a list of all members of the staff from 1835 to 1935, a bibliography of their published works and a few extracts from the publications of Salmon and other early surgeons of the Hospital. Whilst compiling the bibliography, the Committee decided to reprint a number of scientific publications by past and present members of the Staff. Several publications of Sir Charles Gordon-Watson are included in this Centenary Volume and set forth in detail, namely:

(a) *Treatment of cancer of the rectum with radium by open operation* (1927).

(b) *The diagnosis and treatment of carcinoma of the colon* (1932).

(c) *Progress in rectal surgery* (1934).

The British Proctological Society was constituted in December 1912. On 8th July 1913, the Society accepted the offer of the Royal Society of Medicine to constitute it a sub-section of the surgical section of the Royal Society of Medicine, and the first meeting of the sub-section was held the same day at the house of the Royal Society of Medicine. The list of officers of the British Proctological Society at its inception was as follows:

President	Swinford Edwards
Vice-President	Percy Furnivall
Secretary	J. P. Lockhart-Mummery
Editorial Secretary ..	W. Sampson-Handley
Members of Council ..	Charles Ryall and Ernest Miles
Honorary Member ..	Harrison Cripps.

Besides these officers, the first members of the Society were:

H. Graeme Anderson	Aslett Baldwin
Hamilton Drummond	Peter Daniel
Stephen Fenwick	Maynard Heath
W. Maxwell Telling	L. E. C. Norbury

C. Gordon-Watson.

All these officers and members held similar office in the newly constituted sub-section of proctology.

At a meeting of the British Proctological Society in February 1913, Gordon-Watson recorded four cases of strangulated hernia occurring after abdomino-perineal excision of the rectum. This complication was out of a total of 22 abdomino-perineal operations performed by him to that date. Two of these occurred beneath intact skin through the median laparotomy wound. Strangulation was through an aperture in the rectus sheath. One died and one recovered. In a third case strangulation was through an aperture in the pelvic diaphragm. This patient died. In the fourth case, the obstructing agent was a narrow loop-hole which existed between the free edge of the mesentery of the pelvic colon, and the peritoneum of the iliac fossa, external to the colostomy opening (what is commonly known as the " lateral space ").

In the discussion which followed, Gordon-Watson considered the wisdom of fixing the free edge of the mesentery to the parietal peritoneum in order to obliterate any potential space where herniation might occur. This method of closing the lateral space has since been widely practised.

As already stated, the sub-section of proctology came into being in July 1913, with Swinford Edwards as its first President. It was in July 1913 that Gordon-Watson performed his first abdomino-perineal excision of the rectum by Miles's technique. The patient, a man of 60, was in excellent health twelve years later.

Gordon-Watson was President of the sub-section for the years 1921, 1927 and 1928. I was President for the year 1930 and Gordon-Taylor for the years 1935 and 1936. The sub-section became a full section of the Royal Society of Medicine in May 1940. Gabriel was a member of Council of the old sub-section and was President after the sub-section became a full section.

Gordon-Watson was also interested in the subject of diverticulitis of the colon. In an article which he wrote in the text-book named *Surgery*, published in 1920 and already referred to, he states that, when first described, diverticulitis was regarded as a pathological curiosity, but is now regarded as a clinical condition by no means rare—that no part of the large bowel was exempt but that the pelvic colon was the site of election. He noted the origin and position of diverticula in relation to the taeniae coli and to the appendices epiploicae; he referred to complications, including vesico-colic fistula, and to treatment. He made a very important observation that " diverticulitis of the colon associated with a tumour may be erroneously diagnosed on clinical evidence alone as inoperable carcinoma, especially when associated with inflammatory adhesions ".

He also recorded progress made in the surgical treatment of procidentia recti, and its undoubted blessing to the afflicted in chosen cases. He was an advocate of treatment by linear cauterization of the prolapsed bowel.

His article on *Progress in rectal surgery*, 1934, published in the Centenary Volume of St. Mark's Hospital, is comprehensive and full of valuable advice. He stresses progress made in the attack on the sympathetic nervous system, a branch of surgery hardly considered a few years before he wrote this article.

In regard to idiopathic mega-colon, to quote his words: " I have little doubt that pre-sacral sympathectomy in the treatment of this condition has

Fig. 8.

come to stay ". Figure 8 shows a giant idiopathic enlargement of the sigmoid colon (Hirschprung's disease) from the St. Mark's museum. The distended bowel filled the abdomen. It was resected by Gordon-Watson shortly before the valuable work on sympathectomy by Hunter and Royle became generally known. The patient, a women in her forties, had suffered from " toxic constipation " all her life, and had been teased since childhood about her enormous abdomen. The specimen

resected was 22 inches long and 18 inches in the maximum circumference. The result of the operation was eminently successful. The altered appearance which followed was not only a great joy to the patient, but resulted in happy wedlock soon afterwards.

In the concluding sentence of his paper on *Progress in rectal surgery*, Gordon-Watson quotes Percival Pott. Towards the end of the 18th

Fig. 9.

century, on looking back after 50 years of practice, Percival Pott delivered the following eulogy: " Many and great are the improvements which the chirurgical art has received in the last 50 years, and many thanks are due to those who have contributed to them, but when we reflect on how much still remains to be done, it should rather excite our industry than inflame our vanity ". Success or failure in any particular project is a stimulus

to further investigation and knowledge. This dictum is certainly applicable to the surgical art. Interpretation of pathological findings demands much study and thought in order to elaborate lines of treatment.

To illustrate this principle: there are several specimens in the museum of St. Mark's which Gordon-Watson removed for " advanced hyperplastic tuberculous disease of the caecum and colon ", with stenosis and with involvement of the ileum in certain specimens (Fig. 9). In the light of our present knowledge and a recent review of these cases, it would probably be more correct to label some of them as specimens of Crohn's disease, the correct treatment for which is still a debatable point. Crohn described a condition of terminal ileitis about the year 1933.

Until the year 1922 no pathological investigations or tests had been undertaken at St. Mark's Hospital. There was no laboratory and no appointed pathologist. It was the practice for certain elementary investigations to be done elsewhere. I remember quite well how Dr. Stanley Wyard, Pathologist to the Royal Cancer Hospital, would step into the breach and carry out such investigations at his own hospital.

In 1922 Cuthbert Dukes was appointed pathologist to St. Mark's, but research work at the hospital only started as an entity by the stimulus of the foundation of the British Empire Cancer Campaign in 1923. Gordon-Watson was a keen protagonist of cancer research, and collaborated with J. P. Lockhart-Mummery and Cuthbert Dukes in organizing a pathological and research department at St. Mark's.

In many of his writings, Gordon-Watson paid a great tribute to the work of Dukes in the pathological and research department, a tribute shared by all his colleagues. The high standard of efficiency shown by him as a technician, his meticulous care in research and practical application of the knowledge so gained, have won for him the regard and esteem of all who study the science of proctology.

Dukes's postulation of three grades of carcinoma of the rectum, A, B and C, depending on the depth of spread by continuity, is universally accepted. His investigations and interpretation of facts revealed have been invaluable in establishing a true concept of the problems of prognosis and treatment.

I am laying particular emphasis on this department of St. Mark's Hospital since Gordon-Watson was associated with it from its inception, and was one of the first to recognize the importance of a well-organized department, especially in its relation to cancer research. The supreme value of team-work has been well exemplified by Dukes and his assistants in the department, especially H. J. R. Bussey and George Lamb.

The British Empire Cancer Campaign was founded in 1923. Preliminary steps were taken in the early months of that year to found a movement having for its purpose " the promotion, co-ordination and financial support of existing cancer research ". Prior to this time, such research had been activated by a number of different bodies in this country, chiefly the cancer research laboratories of the Middlesex Hospital, the Royal Cancer Hospital, the Christie Hospital in Manchester, and the McRobert Research Lectureship of the Marischal College, Aberdeen.

A Grand Council was formed under the Presidency of H.R.H. the Duke of York, with Sir Charles Gordon-Watson as Chairman of the Investigation Committee of the British Empire Cancer Campaign and a member of the Executive Committee. Sir Charles also represented the Royal College of Surgeons on the Scientific Advisory Committee of the Radium Institute and Mount Vernon Hospital, of which committee he was Vice-President. J. P. Lockhart-Mummery was Chairman of the Executive Committee.

A series of meetings convened by Mr. Locker-Lampson were held at the House of Commons. The preliminary scheme of work of the campaign included the formation of a number of specialized medical and scientific committees, each one representing some definite possible line of research. Grants were soon forthcoming and St. Mark's received a grant of £200 towards cancer research.

The Annual Report of the Grand Council for the year ending May 1925 showed that the committee of St. Mark's Hospital cancer research department included J. P. Lockhart-Mummery (Surgeon), W. B. Gabriel (Assistant Surgeon) and Cuthbert Dukes (Pathologist). The report showed that investigations were being made into the presence of " adenomata of the colon and their relation to carcinoma " and also the " significance of the lymphoid follicles of the intestine in their relation to cancer ". The results suggested that these lymphoid follicles play an important part in the protection of the body against cancer. Investigations were also carried out as to the effect on malignant tumours of large doses of colloidal metals, particularly copper. Another line of investigation was the effect of insulin in cases of inoperable carcinoma.

In his Presidential address of 1927 before the subsection of proctology of the Royal Society of Medicine, Gordon-Watson made the following statements:

" That until a few years ago, the cure of a patient suffering from cancer in various parts of the body depended solely on the possibility of performing a radical surgical operation."

" About 20 years ago [i.e. about the year 1907], X-rays and radium began to be employed to relieve pain in inoperable cases of cancer, and in isolated cases not only remarkable improvement but even apparent cure resulted in certain localisations."

Radium employed with the surgery of access as distinct from surface irradiation only became popular in the late 1920s. In 1910 Gordon-Watson employed it in this way for a sarcoma of the ileum.

More recently X-rays and radium had been deliberately employed to effect cure, not only in inoperable, but also in operable cases. In the spring of 1925, Gordon-Watson became interested in the possibilities of radium treatment for cancer of the rectum. His interest was greatly stimulated by a visit to Professor Neumann at the Radium Institute of Brussels. He was impressed by the results in cases of carcinoma of the rectum treated by interstitial radium after surgical exposure from the perineum and demonstrated in Professor Neumann's clinic. He was stimulated to give the method a fair trial. Professor Neumann came to England later to demonstrate his method at St. Bartholomew's Hospital. Gordon-Watson also visited the Radium Institute in Paris, where he saw the results of treatment by a 10 gm. bomb. This was pioneer work. Professor Regaud, Director of the Institute, was of the opinion that cases of rectal cancer were not sufficiently radio-sensitive to justify treatment with radium.

Gordon-Watson was of the opinion that " the real problem depends so much on the grade of malignancy, the higher grades (3 and 4) being much more sensitive than grades 1 and 2, which predominate. The latter tend to be radio-resistant, but will respond if adequately treated, a higher dose and longer time factor being necessary." For growths in the lower part of the rectum, he often employed an intra-rectal rubber tube, with an inflated outer sheath (Tod's tube), having radium in bulk within the tube and needles strapped to the outer tube for close contact.

His case-book is full of interesting and most fascinating reading. He cites numerous cases in support of the value of radium in the treatment of carcinoma of the rectum, with some truly remarkable results, in cases of inoperable lesions both with and without colostomy.

Gordon-Watson was a pioneer in the use of interstitial radium for the treatment of carcinoma of the rectum. In the paper on *Progress in rectal surgery* he made the following statement: " In 1925 and succeeding years I began to treat cases of carcinoma of the rectum with interstitial radium, combined with the surgery of access, in the hope that I might be successful in developing a technique which in favourable cases would avoid the stigma of colostomy ".

For some years he tried the effect of radium on cases of rectal carcinoma. The method proved a failure in many instances, but he saw that it had a full and fair trial (Gordon-Watson, 1935). Disappearance of the growth was accomplished in a small proportion of operable cases with some brilliant results. His conclusions were, however, that results were too uncertain to

justify the use of radium for an operable case, except when radical operation was contra-indicated on general grounds. In several instances, though in a small proportion, he was able to reduce fixed inoperable lesions to a state of complete quiescence, if not cure. Some of these patients, so treated, remained in good health for periods ranging from 7 to 10 years.

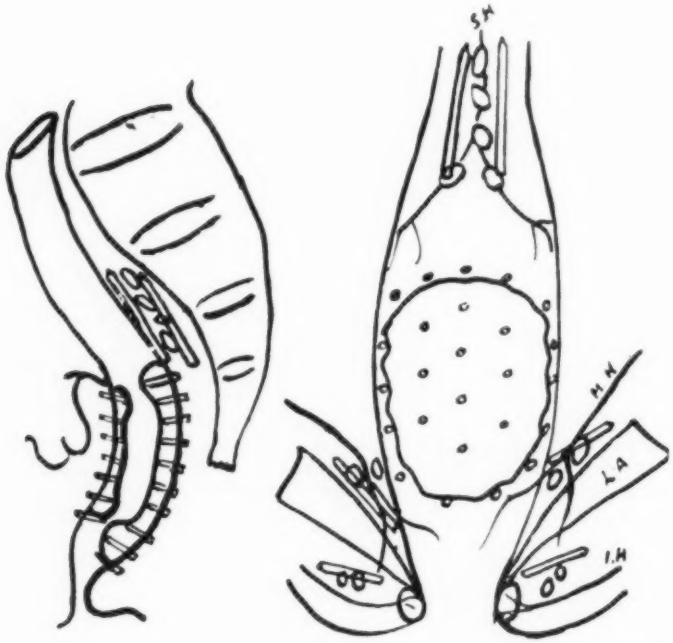


Fig. 10. Diagram illustrating method of implantation of radium needles or seeds in cases of carcinoma of the rectum.

He records several instances of " radium burns " which came under his observation. He found that relief could be given by treatment with diathermy, converting the lesion into a diathermy burn.

In 1931 Gordon-Watson remarked that he had often had the experience when radium failed in treatment " that surgery may then be hampered by fixation, and may likewise fail because penetration and fixation of the rectal wall allows a lymphatic or local spread. It is with small early growths that there is a temptation to avoid radical surgery, yet it is in such cases that radical surgery offers the brightest hope of a cure."

In passing it is of interest to record that the first colostomy performed by Gordon-Watson was in the year 1907 at St. Thomas's Home. This was also the first occasion on which he wore rubber gloves. Previous to that date it was the custom for the surgeon to wear white cotton gloves when operating, if he wore any at all.

Between the years 1927 and 1931 he wrote a number of authoritative papers on the treatment of cancer of the rectum with radium, but after several years of study and investigation, with a careful follow-up of his cases, he discarded this as a routine method.

Though widely known for his versatility in general surgery, he will perhaps be best remembered for his work in the field of surgery of the rectum, and in 1937 he chose as the subject for his Bradshaw Lecture " The origin and spread of cancer of the rectum in relation to surgical treatment ".

In a paper published in the *British Journal of Surgery* (1930), he cites the methods of attack with radium in the treatment of carcinoma of the rectum (Fig. 10).

(*a*) Barrage by open operation from the perineum with needles, with or without a preliminary colostomy.

(*b*) Intra-abdominal radiation with needles or seeds.

(*c*) Radiation *per vaginam*.

(*d*) Intra-rectal implantation of needles or seeds.

(*e*) Intra-cavitary radiation.

(*f*) Surface radiation. (Radium fibrosis with stricture formation was a complication in certain cases.)

In a discussion on radium in the treatment of carcinoma of the rectum and colon at a meeting of the sub-section of proctology on 14th May 1930, opened by Gordon-Watson, Sir Stanford Cade made the following observation: " In the treatment for cancer of the rectum radium may be the method of choice in the future, but to-day surgery has the first place ".

In the discussion, J. P. Lockhart-Mummery said: " I do not consider that radium treatment for rectal cancer has given such good results that we are justified in using it as a substitute for operation. It may prove very useful in conjunction with operation in allowing more local resections to be performed ": in other words, " local resection in association with treatment of the lines of spread by means of radium and without a colostomy ". He had also found that with abdominal radiation a colostomy was not always necessary.

When opening a discussion at the Annual Meeting of the British Medical Association held in Winnipeg in 1930, Gordon-Watson remarked: " Radical surgery for cancer in general involves some mutilation of the human body. The appeal which radium makes to both surgeon and patient is the hope of a cure without disfigurement." His concluding remarks were: " The treatment of cancer of the rectum is still in its nursery stage. Time will show whether selection combined with increased experience and skill will vastly improve results in radium-therapy, or will reveal that radium is too capricious a master and too seldom a servant to be reckoned with as a serious fighting factor in the campaign against cancer. Research on radio-resistance and methods of sensitization is an urgent need. An index of sensitivity and a dose-index are necessary. We must look for help from the Physicist, Biochemist and Pathologist."

In an article entitled *How far can radium replace radical surgery for cancer of the rectum?* (1931), Gordon-Watson's final remarks were: " At present radium is like a wild horse which must be tamed before it can be harnessed to the surgeon's team. Whether it will take the place as leader or wheeler or as a spare remains to be seen." He further states that he had no experience with radium *en masse*. He had, however, vision of things to come when he stated in 1937 that research was busy with giant bombs and X-ray plants working up to a million volts. He mentions that Mottram (1936) had shown experimentally that during treatment by radiation sensitivity rises and falls, and affirms that if treatment could be spaced so as to catch the tumour always at times of high radio-sensitivity, avoiding times of high radio-resistance, better results would be assured. " If this be true, then the flexibility of these stupendous generators of Gamma and X-rays may open the door to results hitherto unobtainable."

In 1933 he himself was operated upon for supposed carcinoma of the pylorus, which fortunately proved to be of an innocent spasmodic nature.

Proctology owes a very great debt of gratitude to Sir Charles for his most valuable research in this line of therapy and for the meticulous care with which he studied his cases and recorded his results. A pioneer is not always to be envied. There is a natural tendency to optimism and wishful thinking. It requires a strong character and an evenly balanced mind to face facts squarely. These characteristics were abundantly displayed by Sir Charles.

At the end of some years of experience, Sir Charles summed up as follows: " Until we are in a position to measure the action of radium with some accuracy, to be able to say with confidence that a given dose of radium administered in a given way for a given time will produce a certain result, we are, I think, in duty bound to advise surgery, mutilating though it is, in preference to radium, for the operable case ".

Gordon-Watson realized that the great difficulties to be contended with in the treatment of carcinoma of the rectum with radium were lack of radio-sensitivity, difficulty in obtaining effective and uniform irradiation, and the presence of ulceration and sepsis of the rectal growth. His published papers indicate that some good results were obtained, but treatment on the whole proved to be disappointing owing to irregular and unpredictable effects. The posterior barrage operation advocated by Neumann proved to be an operation often accompanied by severe complications of wound infection and toxaemia, sometimes lasting for months. Some brilliant results were obtained in the treatment of squamous-celled epithelioma of the anus.

Gordon-Watson was an enthusiast in the use of radium for the treatment of carcinoma of the rectum and colon. After a fair trial, however, he was able to satisfy himself as to the limitations of this line of therapy. He always had one main goal in view, namely the realization of a cure without the stigma of an artificial anus. A great debt of gratitude is due to Sir Charles for his perseverance in striving to attain this goal, and for the valuable principles of therapy he was able to enunciate as the result of his researches.

In 1938 Commander Murray Levick, a Bart's man who had been with Scott in the Antarctic, persuaded Gordon-Watson to join his Public School Exploration Society's Expedition to Newfoundland in the capacity of Surgeon to the Expedition. In his transcripts Gordon-Watson relates many exciting adventures during a time of peace and contentment. This was disturbed by the threat of war. In September 1939 he donned uniform once again and became Consultant to the Army at home, with the War Office as his headquarters.

A memorial lecture is, at its best, only a means of bringing to mind the character, interests and qualities of the man in whose honour the lecture is given. It must needs lack the personal contact. It portrays an aspect of individuality which remains impressed on the minds of those who have lived and worked together. This cannot be adequately expressed by the spoken or written word. To understand a man's " set-up " it is necessary to come into frequent association with him, to work with him as one of a team and to be interested in his hobbies. Only by such means can one fully understand character and professional ability.

Gordon-Watson was a man whose life was made up of many facets: soldier, surgeon, sportsman, a pioneer in cancer research and its relation to radiotherapy. He died at York on 19th December 1949, at the age of 75, and was buried at Dorchester, Oxford. A Requiem Mass was celebrated in London on 11th January 1950. He left bequests to St. Bartholomew's Hospital, St. Mark's Hospital, the British Empire Cancer Campaign, the Research Department of the Royal Collgee of Surgeons of England, and the Royal Medical Benevolent Fund.

At the end of a lecture in memory of a friend and colleague one is left wondering if justice has been done in one's endeavour to portray essentials so that others may obtain a right perspective. The world is a better place for the life and work of Charles Gordon-Watson. He was a great man with a wonderful record of life lived to the full. Whatever he put his hand to he also put his heart into.

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ADMISSION TO THE FELLOWSHIP BY ELECTION

At the meeting of Council in May, four practitioners of twenty years' standing were admitted to the Fellowship. (Left to right) Sir James Paterson Ross, Bt. (President), with the new Fellows, Dr. Frankis T. Evans, Surgeon Captain J. L. S. Coulter, Dr. E. F. Scowen and Professor E. C. Amoroso.

AN EXPERIMENTAL STUDY OF PROPULSION IN ISOLATED SMALL INTESTINE, AND APPLICATIONS TO SURGERY IN THE NEWBORN

Hunterian Lecture delivered at the Royal College of Surgeons of England

on

10th December 1959

by

H. H. Nixon, M.A., F.R.C.S.

Surgeon, Queen Mary's Hospital for Children, Carshalton, and The Hospital for Sick Children, London.

I WOULD LIKE to describe a clinical problem, some experiments which were carried out in an attempt to elucidate it, and the results of clinical application of the findings.

The problem is that of failure to relieve intestinal obstruction in the newborn baby after operations in which the anastomosis appears to be quite adequate. Figure 1 shows a specimen from such a case. It can

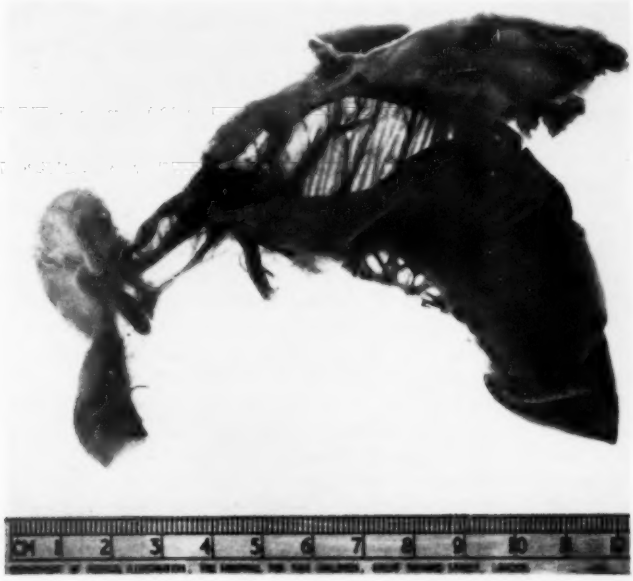

Fig. 1. Showing well healed anastomosis in terminal ileum, about 1 cm. diameter. Yet functional obstruction persisted and the baby died.

be seen that there is a good anastomosis present and yet this child died of persisting intestinal obstruction. Several explanations have been adduced for this kind of occurrence (Table I). *Adynamic* ileus is an obvious suggestion following a surgical operation. But the newborn baby is remarkably free from this post-operative complication and one is frequently surprised by the rapidity with which bowel function returns in the satisfactory cases, and indeed it may persist even in the presence of a frank peritonitis for some time. The *distal bowel* beyond an atresia is minute, often being described as the size of a lead pencil, and it has been suggested that the trouble is due to difficulty in dilating such collapsed bowel. However, it is found that in the right circumstances this bowel can develop very rapidly to a normal calibre and it is only disuse which has made it so small, not hypoplasia. Hoppu (1951) in a careful study of the treatment of atresia including experimental investigations in baby animals came to the conclusion that the trouble was *plugging* of the anastomosis by inspissated bowel content. He suggested that this was inevitable if a primary suture anastomosis was carried out in a tube of such small calibre and put forward the suggestion of the use of a prosthesis. It is not a very attractive suggestion; for even in his own experiments,

TABLE I

1. Adynamic Ileus.
2. Minute Distal Bowel.
3. Plugging of the Anastomosis.
4. Adhesions.
5. *Inefficient Enlarged Proximal Loop.*

although the prosthesis reduced the frequency of anastomotic plugging, it increased the tendency to break down. Another suggestion has been the presence of *adhesions* around the anastomosis interfering with its function.

It was decided to test Hoppu's suggestion by carrying out similar *anastomotic experiments* in young rabbits. Young rabbits were chosen because they have bowel of a similar size to the newborn and also the wall has a similar texture and toughness of the submucosal layer which is all-important in holding sutures. The use of other animals such as baby kittens is not so satisfactory, because their tougher bowel is easier to repair and hence they give less scope for the comparison of different techniques. Hoppu's overall mortality with baby rabbits was 66.7 per cent. I carried out anastomosis in the ileum of 70 baby rabbits. Four techniques were used as shown in Figure 2. First, a side-to-side anastomosis with one layer of invaginating mattress sutures having a stoma 2 cm. long. Second, an end-to-end anastomosis with one layer of interrupted sutures. Third, an oblique end-to-end anastomosis was performed, the bowel being cut along the anti-mesenteric border until an anastomosis 2 cm. long was obtained. Fourth, an end-to-end anastomosis with two layers of

sutures deliberately turning in a large cuff which seemed virtually completely to occlude the intestine.

It will be noticed that the survival rates are a good deal better than those of Hoppu, being roughly twice as high. I would also draw your attention to the fact that although the differences in survival rates are not statistically

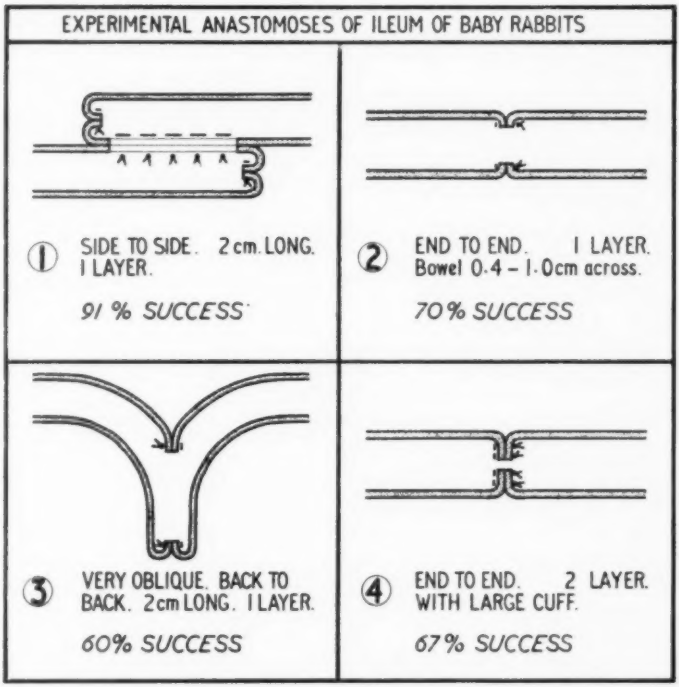
EXPERIMENTAL ANASTOMOSES OF ILEUM OF BABY RABBITS
① SIDE TO SIDE. 2 cm. LONG. 1 LAYER.
91 % SUCCESS
② END TO END. 1 LAYER. Bowel 0·4 – 1·0 cm across.
70 % SUCCESS
③ VERY OBLIQUE. BACK TO BACK. 2 cm LONG. 1 LAYER.
60% SUCCESS
④ END TO END. 2 LAYER. WITH LARGE CUFF.
67 % SUCCESS

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Fig. 2. Results of anastomoses of ileum in 70 baby rabbits of weights 310 to 1,550 grammes—792 grammes average.

significant at these numbers, in fact the best and the worst results were obtained in the two types of anastomosis which provide the longest stoma. Furthermore, the formation of a big cuff in the two-layer end-to-end anastomosis had virtually no effect on the survival rate.

It appeared to me that the important factor in a suitable technique was the ability to obtain accurate *serosal apposition*. This seems more important than the size of the stoma produced. It seems reasonable to

assume that the result of accurate serosal apposition is prompt healing with minimal inflammatory reaction, and hence a stoma which can rapidly adapt itself to the necessary size for passage of contents.

I think it would be unwise to take results from the baby rabbit straight to the human baby and it is important to interpret the results of animal experiments rather than to apply them unchanged to human cases. There is an important difference in the conditions pertaining in the treatment of intestinal obstruction in the newborn and those of the experiments with the baby rabbits. In the baby rabbits the two pieces of bowel which are being joined are of the same size. In our operative cases, however, the proximal bowel is considerably larger than the distal bowel. Under these

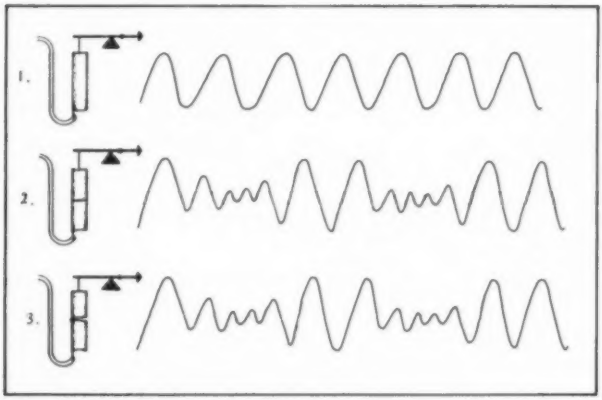

Fig. 3. Study of motility in waterbath, diagrammatic.
1. A length of ileum.
2. A length including an anastomosis.
3. Two shorter pieces of ileum tied end to end by a suture.
Showing no evidence of co-ordination of movement across the healed anastomosis. Exactly similar records in 2 and 3.

conditions an end-to-end anastomosis cutting back the anti-mesenteric border of the distal bowel to obtain an adequate-sized stoma becomes in fact a convenient technical procedure, and therefore achieves the important condition of accurate serosal apposition without the risk of complications which may arise from a side-to-side anastomosis. For to make a side-to-side anastomosis in the extremely collapsed bowel of the human baby beyond an atresia it may be difficult to turn in the blind end neatly in cases where this is necessary. More important is the late hazard of the development of a blind bulb of bowel with its ill effects on nutrition and the risk of ulceration and perforation. These complications have occurred in my experience.

Briefly, then, it seems that Hoppu was overstating the case in suggesting that anastomotic plugging was inevitable in bowel of such a small calibre, and that by attention to technique it is possible to avert this trouble. The sacrifice of the baby rabbits at varying periods after operation also gave one the opportunity of assessing the role played by adhesions in the early stages of healing. It was found that fibrinous adhesions and attachment of adjoining loops of bowel were the rule rather than the exception in the early post-operative period and they gave rise to no trouble in the rabbits. One gained the impression that providing the bowel starts to function early after anastomosis then such adhesions are unlikely to fibrose into obstructive shapes. It is easy to imagine how they might develop more readily into such obstructive bands if the bowel lies inert for some time after the operation.

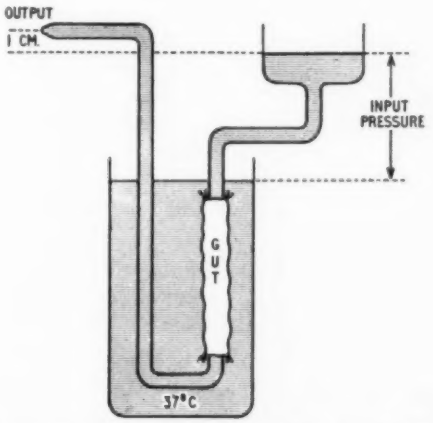

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Fig. 4. The principle of the "gut pump".

The animals were sacrificed at varying times after operation in order that the length of bowel including the anastomosis might be examined for function and compared with the segment of ileum immediately adjoining it as a control. My first experiments were carried out in the usual isolated organ bath set up recording the longitudinal contractions of the bowel by means of a pen recorder on a smoked drum. Figure 3 shows the kind of pictures obtained. There is a regular sine wave produced by the periodic contractions of the normal ileum. The piece of ileum containing an anastomosis shows waves of periodically greater and smaller amplitude. Exactly the same picture is obtained if one ties two pieces of bowel end-to-end and records their movement. In other words, the picture is that

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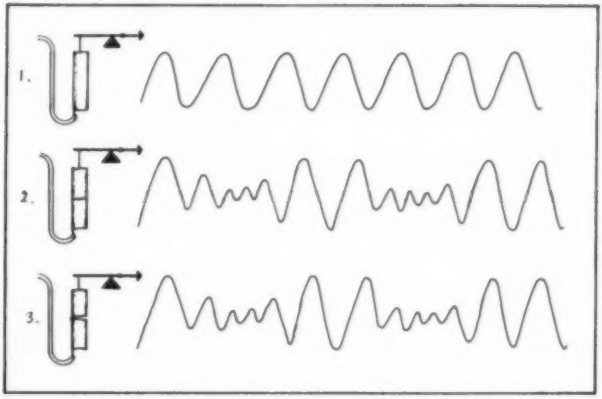

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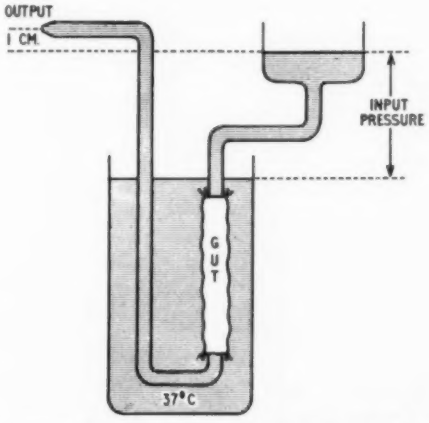

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of two pieces of bowel contracting with their own rhythm and with no transmission of impulse from one to the other to co-ordinate their movements. (It was found that the bowel was capable of such movement as early as two days after operation.) Yet the bowel from these animals had been functioning quite efficiently in life. Clearly the passage of a bolus through the anastomosis must in life be a sufficient stimulus to start the contraction of the bowel beyond.

It seemed that it would be more valuable if one could devise some apparatus which would enable one to measure the actual propulsion of fluid through a segment of bowel, rather than to rely on the indirect evidence of these longitudinal contractions in the usual simple isolated

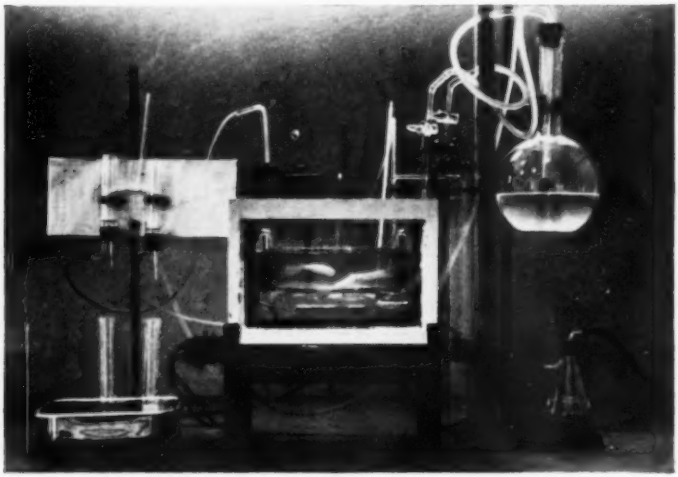


Fig. 5. The gut pump developed to study two lengths of bowel simultaneously under similar conditions.

organ bath experiments. The ability to propel contents is, after all, the criterion of efficient motility. It was confirmed in earlier experiments that much activity might occur without propulsion. It was for this reason that the machine I called a "gut pump" was devised. The principle is simple and is shown in Figure 4. The bowel is immersed in a water bath with a tube in each end. The tube to the proximal end comes from a large reservoir, the height of which can be adjusted to any required level above the water in the bath. This provides an inlet pressure. The outlet **U** tube can also be adjusted so that it may be maintained constantly 1 cm. higher than the inlet. This gives a constant pressure of 1 cm. of solution against which the bowel has to work in order to propel its contents. The appara-

tus in practice works out to be considerably more complicated than would seem from this diagram and is shown in Figure 5. The object of this development is to elaborate the apparatus so that two pieces of bowel are being examined simultaneously under as nearly identical conditions as can be achieved. A similar apparatus, though considerably more elegant, has been devised by Dr. Bülbring (1958). The principle is, of course, not new. For example Gregory (1950), and Vaughan Williams and Streeten (1950), have used a Thiry-Vella loop technique in dogs which measures propulsion in a similar fashion. Their modified Trendelenberg apparatus for small animals, however, would seem to me to have an inherent disadvantage in that it includes a one-way valve. It is therefore inevitable that any diminution in the volume of the gut in their apparatus must produce propulsion in one direction. Such a valve is not present at least in the middle ranges of the human intestine and it would seem sounder to have an apparatus without one. Also, their apparatus keeps the gut under tension, which is unnatural.

TABLE II

FUNCTION OF BOWEL CONTAINING ANASTOMOSIS COMPARED WITH NORMAL ILEUM

Experiment No.	1	2	3	4	5	6	7	8	*Average*
Output of Anast. Segt.	3	16	13	8	11	10	7	7	9 ml./5 minutes.
Output of Control	1	2	15	12	16	9	4	8	8 ml./5 minutes.
Optimum Inlet Pressure—Anast.	2.5	1	3	3	3.5	3	4	5.5	3 cm.
Optimum Inlet Pressure—Control	2.5	1	2	2	2	2	2.5	4	2 cm.

plus 2 experiments technical failures

Table II shows the volume of water propelled by segments of gut including the anastomosis and the control segments alongside them in the gut pump. It will be seen that they were completely efficient compared with the normal gut—and this as early as five days after operation in one of the experiments.

An observation early in my paediatric surgical experience led me to consider another possible cause of inefficiency of the anastomosis. In a short period in 1949 I had the opportunity of operating on three babies suffering from jejuno-ileal atresia. In two of them the bowel proximal to the anastomosis was so distended by delay in diagnosis that intramural strangulation had occurred, and the proximal bowel approached the tension gangrene of Rutherford Morison. It was therefore necessary to resect the damaged bowel before performing an anastomosis. Both these children did well. A third baby was diagnosed earlier and came to

hospital with a bowel proximal to the atresia which was grossly enlarged but healthy looking. I therefore performed an anastomosis to the end of this bowel without resection. The baby went on to die some weeks after operation, the anastomosis never having functioned properly. The abdomen was re-opened during this period and a further 2 cm. long side-to-side anastomosis performed without any effect on the outcome. There were no troublesome adhesions and the distal bowel had been dilated up to normal dimensions. The bowel sounds were not only audible but easily palpable in the enlarged proximal loop.

Indeed it was the Ward Sister who drew my attention to the fact that, after feeding, the milk could be felt to reach the right iliac fossa, where it could be felt churning in the bowel. But it did not go on through the anastomosis. This led me to consider that although this enlarged bulb of bowel was contracting these contractions might not be efficient in propulsion. If this was true it would be reasonable to suggest that the enlarged proximal bulb of bowel should be resected in all cases of atresia whether it were devitalized or not. It was then decided to try to perform some experiments which might throw light on this hypothesis of inefficient function in the enlarged bowel.

TABLE III

EXPERIMENT 101

Inlet Pressure cm.	*Enlarged bowel Output/5 mins. in ml. (A)*	*Normal ileum Output/5 mins. in ml. (B)*	*Totals*
1.1	drops	5.5	16 ml. A
2.0	14	13	
2.5	2	22.5	41 ml. B.
4	34	14.5	87 ml. A
6	53	drops	14.5 ml. B

I found that by dividing the ileum of a baby rabbit at two points and reversing a segment about 3 cm. long it was possible to produce a chronic obstruction which allowed the rabbit to survive and thrive, but produced a hypertrophied and enlarged loop of bowel proximal to it. The normal bowel was about 0.8 cm. diameter. The enlarged loops varied from 1.1 to 2.5 cm. It was then possible, by sacrificing the animal some weeks later, to compare the function of the enlarged bowel with the normal bowel from below this reversed segment in the gut pump. The results of the first experimental trial of such a loop of bowel are shown in Table III. It will be seen that the hypertrophied bowel was more efficient in propulsion than the normal bowel at a high inlet pressure. However, at the lower inlet pressure, such as would obtain in an unobstructed animal, it was less efficient. A further series of fourteen experiments in all were carried

TABLE IV

FUNCTION OF ENLARGED BOWEL COMPARED WITH NORMAL ILEUM

Experiment No.	1	2	3	4	5	6	7	8	9	10	11	12	*Average*
Max. propulsion Enlarged bowel	80	99	58	50	53	83	15	98	44	27	9	34	54 ml./ 5 mins.
Max. propulsion Normal ileum	42	19	28	35	77	24	11	92	40	29	6	22.5	35 ml./ 5 mins.
Optimum inlet pressure Enlarged bowel	8	6	6	5	3	6	10	4	8	6	7	4	6 cm.
Optimum inlet pressure Normal ileum	4	6	4	4	5	2	4	4	2	4	1	2.5	3.5 cm.
At 2 cm. inlet pressure Enlarged bowel	19	10	18	31	24	33	drops	15	4	15	2	2	14.4 ml. in 5 mins.
Normal ileum	15.5	2	10	10	8	24	4	34	40	5	4	22.5	14.5 ml. in 5 mins.
At 4 cm. inlet pressure Enlarged bowel	50	93	55	18	23	31	5	98	5	24	drops	34	
Normal ileum	42	12	28	35	36	35	11	92	26	29	drops	14.5	
At 8 cm. inlet pressure Enlarged bowel	80	89	37	39	n.r.	n.r.	12	32	44	24	5	n.r.	
Normal ileum	13	1	5	7			4.5	32	8	11	1		

Periods when the normal bowel was more efficient than the enlarged are boxed in on the chart. In experiments 7, 9 and 12 the inefficiency of the enlarged loop at low pressures was marked. The complete figures for all the pressures tested are r ot given in order to simplify the presentation. Two further experiments were technical failures.

out. Two were unsatisfactory for technical reasons and Table IV shows a summary of the results of the series. It can be seen that there were wide variations in the efficiency of the pieces of bowel and this is almost certainly in part artefact due to the short periods of time (5 mins. each) over which propulsion was measured at each pressure. It was not thought practical, however, to take long periods for each measurement otherwise the bowel was likely to become fatigued before the end of the experiment. The averages shown in the last column tend to confirm the impression that the hypertrophied and enlarged bowel is more powerful than the normal, but that it requires a higher pressure to produce this efficient

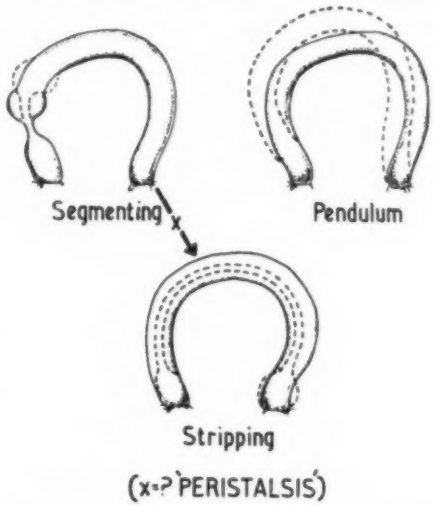


Fig. 6. Showing the three types of movement observed. Some segmental contractions moved a little way down the bowel without becoming a full stripping contraction. Such an intermediate form (X) was reminiscent of the classical description of peristalsis.

propulsion. The last lines show that at input pressures of 4 cm. or less the enlarged bowel was less efficient than the normal bowel, at times, in nine of the twelve cases. *These experiments therefore seem to suggest that the enlarged bowel is adapted to the high pressures of obstructive conditions and may be inefficient when a normal pressure gradient is restored.* It may be stressed that the degree of hypertrophy and enlargement obtained in these experiments was variable and in most cases was considerably less than that found in the human cases of atresia. In these more grossly enlarged bulbs the relative inefficiency may well be more marked. Further work is needed to assess separately the effects of the two changes of muscular hypertrophy and of enlargement.

The performance of these experiments gave one the opportunity to observe peristalsis and some comments may be of interest. Starling described peristalsis as being a wave of contraction passing down the bowel preceded by a wave of relaxation. But Alvarez (1947) has said that " a phenomenon which can be observed only after distending with a balloon the denervated bowel of a recently purged dog should not be called the law of the intestine ". There may be some justification in this comment for it is interesting to see that even in Starling's own experiments the type of contraction described was by no means regularly demonstrable. When I observed these loops of bowel in the water bath there seemed to be three kinds of contraction which I have tried to demonstrate in Figure 6. The pendulum movements are a rocking and twisting movement of the loop, apparently due to slight contractions and relaxations of its so-called longitudinal muscle. Carey (1921) has said that the longitudinal muscle is not truly longitudinal. It is in the nature of an open spiral as compared with the close spiral of the so-called circular muscle. Such a spiral arrangement of the fibres would seem simply to account for the twisting movement seen when a loop of bowel is tethered in a water bath. There were also segmental contractions in which a piece of bowel would narrow and relax and then an adjacent piece might narrow and relax. This kind of movement was sometimes associated with a certain amount of propulsion, but the main propulsion came as a copious intermittent passage of the contents resulting from stripping or mass contractions. About every seventh segmental contraction seemed to persist and then spread down the bowel till the whole segment would be gripped tight and would then gradually relax again. It was not a wave passing down the intestine, but a contraction spreading to involve the whole length of the loop. One sometimes saw abortive attempts at this stripping which would run a little way down the bowel before stopping and it seemed that such abortive stripping contractions were very like the classical description of a peristaltic wave. They were of very much less importance in propulsion than the stripping contractions. It was interesting to speculate why some contractions persisted and became stripping contractions whereas others died out. After each segmental contraction it seemed that the bowel relaxed a little wider until a threshold of tension was reached and a stripping or rush contraction began. About every seventh contraction seemed likely to produce such a contraction with vigorous propulsion under these experimental conditions.

The gut pump also allowed observation of the effect of reversing a piece of bowel. It was found that the polarity of the bowel was only relative. It could be made to propel in the reverse direction, although not so efficiently (Table V).

Now I would like to turn to the application of these findings to intestinal obstruction in the newborn. First I would like to consider *jejuno-ileal*

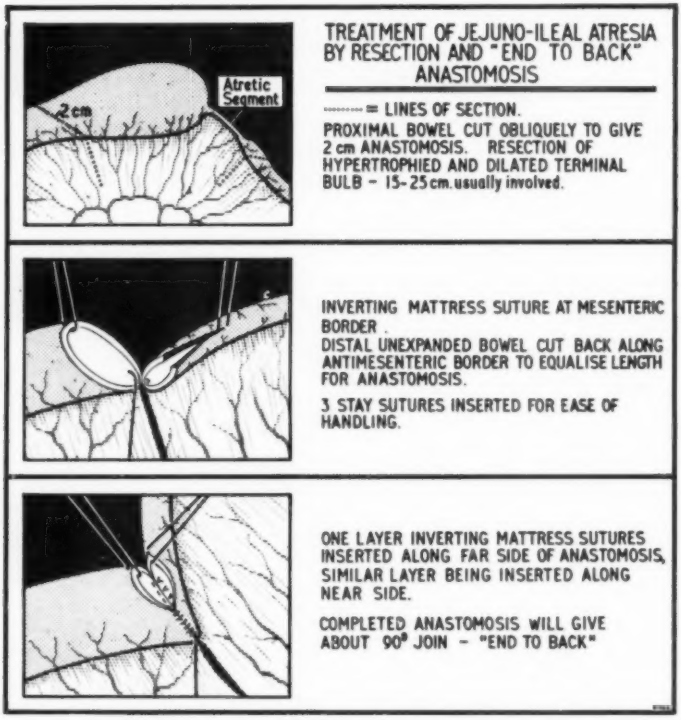
TABLE V

POLARITY OF BOWEL

Inlet pressure 6.5 cm. Output in mls./5 mins.

	Ileum A	*Ileum B*
"Isoperistaltic"	25	60
"Retroperistaltic"	19	20

atresia and stenosis. They are an important group of the neonatal obstructions because the babies are usually normal outside their alimentary tract even though there may be multiple lesions within it. It is an acute on chronic obstruction. There has been chronic obstruction to the attempted passage of meconium throughout the later part of foetal life, and the acute obstruction follows after birth, when air is swallowed and the hazards of infection are also introduced. The length of time


TREATMENT OF JEJUNO-ILEAL ATRESIA BY RESECTION AND "END TO BACK" ANASTOMOSIS
2 cm
Atretic Segment
..... = LINES OF SECTION.
PROXIMAL BOWEL CUT OBLIQUELY TO GIVE 2 cm ANASTOMOSIS. RESECTION OF HYPERTROPHIED AND DILATED TERMINAL BULB – 15–25 cm. usually involved.
INVERTING MATTRESS SUTURE AT MESENTERIC BORDER.
DISTAL UNEXPANDED BOWEL CUT BACK ALONG ANTIMESENTERIC BORDER TO EQUALISE LENGTH FOR ANASTOMOSIS.
3 STAY SUTURES INSERTED FOR EASE OF HANDLING.
ONE LAYER INVERTING MATTRESS SUTURES INSERTED ALONG FAR SIDE OF ANASTOMOSIS, SIMILAR LAYER BEING INSERTED ALONG NEAR SIDE.
COMPLETED ANASTOMOSIS WILL GIVE ABOUT 90° JOIN – "END TO BACK"

Reproduced by kind permission of the Editor of the "Archives of Disease in Childhood".

Fig. 7. Technique of elective resection and "end-to-back" anastomosis.

during which the foetal obstruction has existed probably varies considerably and aetiological considerations will be discussed later. On the assumption that the proximal loop of bowel is adapted to the obstructive conditions and likely to be ineffective in propulsion at the lowered pressures following relief one recommended *elective resection* of 15 to 25 cm. of bowel proximal to the atresia with end to back anastomosis. Figure 7 illustrates the technique we have used. I was able to persuade some of our surgeons of the value of this procedure and others preferred to continue with a simple anastomosis for the time being. The result was that over the next three years we obtained in a series of 33 cases almost equal numbers treated with and without resection. It may be pointed out that such a trial is loaded against the resection group because this inevitably includes all the cases diagnosed so late that vascular damage to the bowel necessitated resection. Nevertheless the survival rate was doubled in this group—over two-thirds surviving against less than one-third (Table VI).

TABLE VI

JEJUNO-ILEAL ATRESIAS 1949–1955

	Cases	*Survivors*	*Per cent.*
Resection and anastomosis	16	11	68
Simple anastomosis	17	5	29

It is worth considering the alternative possibility of avoiding resection by carrying out anastomosis and accompanying it with a proximal enterostomy to deflate the enlarged bowel and give it the ten days or so necessary to re-adapt to normal pressures. I have preferred to avoid this intubation, which has its own disadvantages; but it is a reasonable procedure with the same end in view, and others such as Gerrish (1955) have obtained good results in this way. Indeed, two of the cases in our own group anastomosed without resection which survived only did so after such an enterostomy was added as a secondary procedure. It may well be the treatment of choice in the occasional case where the intestine is so short that it would seem wise to avoid removing any more of it. For it is not uncommon for the bowel to be shorter than average in these cases of jejuno-ileal atresia and it seems that a length of bowel is often lost at the site of the atresia. In a few cases this loss may be so great as to put the remaining bowel near the limit of that required for healthy survival. In such an occasional case I would prefer anastomosis with proximal enterostomy instead of elective resection.

Benson (1955) gave a 70 per cent. survival in a series of 14 patients treated by elective resection and anastomosis. He emphasized the possibility of a short bowel and observed that 42 cm. of ileum or 89 cm. of jejunum could be safely removed. But it is the amount of bowel left behind that matters. I would suggest that at least 30 cm. of ileum should be retained if possible.

Here I would like to digress to mention briefly some of the findings of Dr. Bodian and myself (1955) in a pathological examination of 22 cases of jejuno-ileal atresia and stenosis. The four types of lesion seen in jejuno-ileum are the blind bulb with a gap between the bowel ends; the type with a cord between the ends; a stenosis and, as a rarity, a mucosal septum. In this series there was no instance of a septum. We found that the first layer to be lost in affected bowel was the mucosa—it was replaced

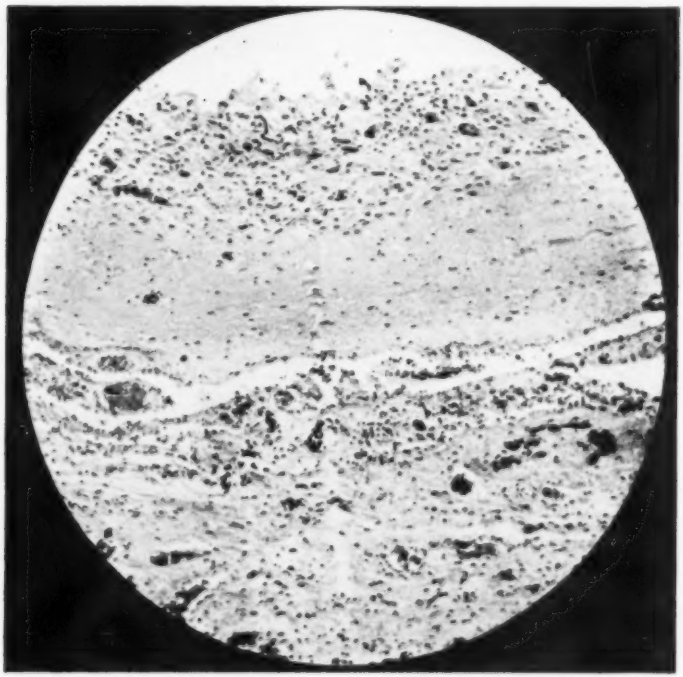


Fig. 8. Showing epithelial squames in the bowel below an atresia, and also the replacement of the mucosa by fibroblastic tissue.

by loose fibroblastic tissue. This is difficult to explain on the commonly accepted theory of the origin of atresia by persistence of the solid stage of the intestine in which it is plugged by epithelial hypertrophy—as suggested by Tandler (1900) and Förssner (1907). Furthermore, epithelial squames have been seen in the bowel below an atresia and the foetus bears no such squames to swallow until the fourth month, which is later than the solid stage of the intestine (Figure 8).

We found gross meconium peritonitis in six of the 22 cases and localized or microscopic lesions in 9 others. Three more showed areas of meconium peritonitis in the wall of the affected segment (Figure 9). There was evidence of volvulus of all or part of the midgut loop in 11 cases with agglomerations of twisted bowel between the blind ends of the atresia (Figure 10). Mesenteric fixation was deficient in almost half of the cases

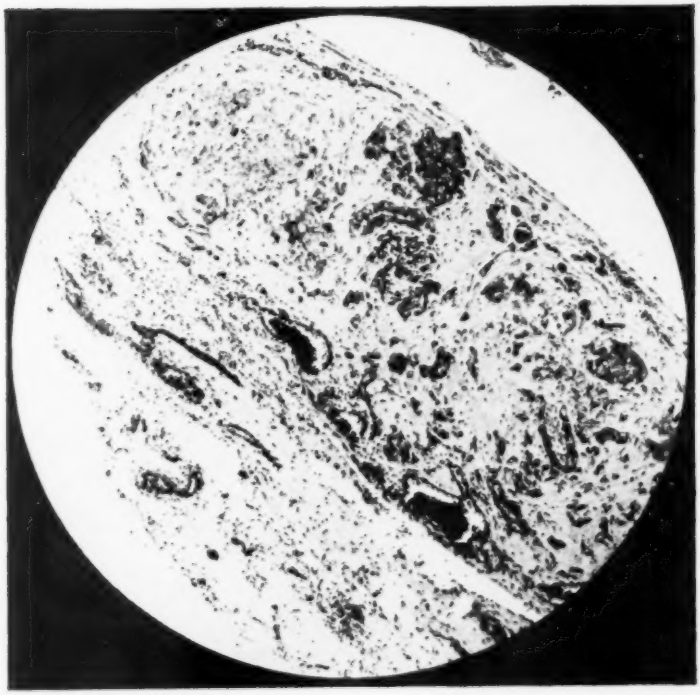


Fig. 9. Showing an area of meconium peritonitis in the wall of the bowel in the region of an atresia.

examined. All this is more in keeping with a vascular accident to the already formed bowel as the cause of the atresia; a concept which has been revived by Louw and Barnard (1952 and 1955). In his recent Moynihan lecture Louw (1959) described their brilliant experiments on puppies *in utero* in which atresias were produced by such methods as ligaturing vessels supplying the ileum.

From the nature of the lesions I put forward the hypothesis that the accident might often be incarceration of the physiological umbilical hernia of the foetus; a suggestion which had been made by Clogg as long ago as 1904. Mr. Tibbs has kindly shown me the specimens from a case of his in Newcastle in which the remnants of the snared bowel in an omphalocele were still present at birth along with the atresia. Gröb (1960) in his Liverpool lecture this year described a similar case. So the proposition seems no longer mere hypothesis.

Fig. 10. Ileal atresia. The type with a complete gap between the enlarged (upper) bowel proximal to the atresia and the collapsed (lower) bowel below it. On the right is shown the isolated mass of twisted bowel found between the blind ends.

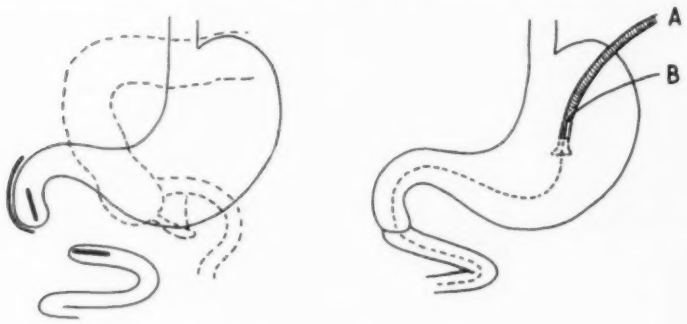
Other types of accident undoubtedly occur—for example, one of my cases had an unmistakable foetal intussusception in the atretic area.

This aetiological concept is of some practical interest because it accounts for the fact already mentioned that bowel often seems to be lost at the site of atresia. The total bowel length may be considerably reduced from the normal—a point to be borne in mind when considering further resection.

It may well be that the hypothesis of persistence of epithelial plugging might account for some of the duedonal atresias. Certainly several facts

suggest that these may differ fundamentally from atresias of the mobile midgut loop. One third of our duodenal atresias were Mongolian idiots—none of those with only jejuno-ileal atresia were. Stenosis is relatively much more common in the duodenum than in the bowel beyond, and so are mucosal septa. Meconium peritonitis has not yet been seen in association with duodenal atresias.

Now to consider the treatment of *duodenal atresia*. Here one has the same problem of an enlarged and hypertrophied bowel proximal to the atresia. A typical case has an enormously dilated proximal duodenum and incompetent pylorus. After anastomosis it is easier for the baby to



A. For Suction.

B. For Transanastomotic Feeding.

Fig. 11. Usual technique used in duodenal atresia. Incision of peritoneum to right of proximal duodenum allows it to be swung over the distal bowel. Incisions are made in the antimesenteric border of each blind end reaching their tips, and the anastomosis performed with one layer of inverting mattress sutures of silk. A gastrostomy tube is inserted for efficient gastric suction and a fine P.V.C. tube is passed through it and through the anastomosis (before its completion) to allow postoperative jejunal feeding.

vomit back feeds than to drive them through the anastomosis. It is frequently found after these operations that the baby seems to do well until one tries to increase the feeds above about half their anticipated requirements. Then vomiting occurs. Various forms of jejunal feeding have been used. For example, transanastomotic tubes such as those of Ehrenpreis and Sandblom (1949), and even jejunostomy as used by Gourevitch (1957), have some success in getting feeds into the baby in the early postoperative stages. However, even with a jejunostomy there is some tendency for the feed to regurgitate into the stomach; presumably because the indwelling tube irritates the jejunum and causes spasm beyond it. It is my present policy to carry out an oblique end-to-end

duodeno-duodenostomy in these cases with a limited mobilization of the duodenum, and a fine transanastomotic tube is passed through a gastrostomy tube (Fig. 11). The gastrostomy is used as the most efficient way of keeping the stomach empty and preventing the dangers of vomiting and pulmonary inhalation. The transanastomotic tube is used for postoperative feeding. It is important if this technique is used to avoid unnecessary dissection of the duodenum which may endanger the ampulla of Vater. Such mobilization is not required to obtain easy apposition of the ends in the usual case. All that is needed is incision of the peritoneum

Fig. 12. (*a*) A premature baby being treated for duodenal atresia in an incubator. As well as even temperature and isolation the incubator enables nursing to be carried out in a high humidity. This is a valuable prophylactic of inspissation of mucus in the bronchial tree—a potent cause of postoperative pulmonary troubles in these small patients.

(*b*) The same patient at one year of age alongside her twin, whose weight she then exceeded by 8 ounces. These babies do not need to become puny children, and are well worth the skilled nursing they receive.

down the right side of the duodenum to allow the pouch to swing over to the left and incision of the antimesenteric border of the two ends of the bowel.

I have recently carried out such an end-to-end duodeno-duodenostomy with a transanastomotic tube in six cases with five successes. The baby who died did so from pneumatosis intestinalis in the ileum at a point distant from an apparently satisfactory operation.

However, the situation here with duodenal atresia differs from that in jejuno-ileal atresia in that delay in function of the anastomosis is less catastrophic. For here distension of the proximal loop is in no danger of progressing to intramural strangulation as it is lower in the intestinal tract.

For tension is relieved by back-flow to the stomach. One can therefore afford to carry on these babies with small oral feeds and intravenous assistance until they are able to take full feeds, even though this may take up to three weeks in some cases. However, their alimentary needs cannot be fully met by intravenous fluids and inanition doubtless contributes to the mortality, especially among the prematures. If one can find a reliable technique for feeding milk to the babies reasonably early after operation this will be greatly preferable to the present need often to rely for some time on skilled nursing and intravenous fluids (Fig. 12 (*a*) and (*b*)).

Finally, I would like to consider *meconium ileus*. Hiatt and Wilson in 1948 produced the first hopeful paper on this subject. They reported eight cases of which five survived. Their treatment had been enterotomy with saline injection into the bowel so as to strip off the inspissated meconium and enable the meconium to be milked out of the bowel. The enterotomy was then closed. They commented in their paper on the fact that two of the deaths resulted from failure of the greatly distended loop of bowel proximal to the obstruction to develop proper peristalsis. As a result it dilated further and vascular changes and insufficiency developed. This is the same problem of acute on chronic obstruction producing enlarged bowel which one may presume to be inefficient at lower pressures when the obstruction is removed. There is progressively dilating bowel down to the site of obstruction, which is usually in the ileum. Here, a maximally enlarged, hypertrophied and dilated loop is followed by a cone of narrowing over several inches. The contents of the cone are putty-like and the bowel below is collapsed. The best results reported in meconium ileus are probably those of Gross (1953), who prefers to resect this most enlarged loop of bowel and make a double-barrelled enterostomy, which is closed soon after when the bowel contents have been liquefied. At Great Ormond Street we have had better results with resection of this loop; evacuation of the contents of the remainder of the small bowel in a manner similar to that of Hiatt and Wilson, followed by primary anastomosis. The injection of 3 per cent. hydrogen peroxide instead of saline as advised by Olim and Ciuti (1954) has made emptying of the gut easier. In our hands this method has been preferable to enterostomy, but even then our results are not as good as those of Gross. Bodian recently quoted our Hospital figures in a lecture here. May I remind you of them? Of 60 cases of meconium ileus, complicated and uncomplicated, almost 50 per cent. have been relieved of their intestinal obstruction. But only seven of these babies are still alive. The others have almost all succumbed to staphylococcal chest infections, the result of the underlying generalized disease of mucoviscidosis (cystic fibrosis) from which these babies suffer. From the intestinal point of view, therefore, the results are reasonable, but from the baby's point of view we have another and perhaps more difficult problem to solve, outside the intestine.

In conclusion I would like to say that this work was begun as a research student at The Hospital for Sick Children, Great Ormond Street, and in the Physiological Department of this College. I would like to express my thanks to all my colleagues at these Institutions and to the nurses for the help they gave me throughout, and particularly to Mr. Drewell for his technical advice and assistance.

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HAND SURGERY

THE HAND CLUB and The Second Hand Club will hold an Open Meeting at the Royal College of Surgeons, London, at 10 a.m. on Saturday, 19th November, 1960.

Papers from non-members would be welcomed.

Further details can be obtained from Mr. H. Graham Stack, F.R.C.S., 150 Harley Street, W.1.

MILITARY SURGERY:

MISSILE INJURIES IN CYPRUS

Hunterian Lecture delivered at the Royal College of Surgeons of England

on

28th January 1960

by

Colonel J. C. Watts, O.B.E., M.C., F.R.C.S.

" And that it was great pity, so it was,
This villanous saltpetre should be digg'd
Out of the bowels of the harmless earth,
Which many a good tall fellow hath destroy'd
So cowardly; and, but for these vile guns,
He would himself have been a soldier."

W. Shakespeare (Henry IV, Part I).

TO THE MEDIAEVAL surgeon the introduction of gunpowder and the lethal nature of the wounds it produced was so shattering that the presence of a specific poison was suspected (de Vigo, 1514) and cauterization of wounds employed in a vain attempt to mitigate these dread effects. Botallo (1560), however, attributed the poisoning to the presence of foreign bodies and to the retained dead tissues.

Ambroise Paré (1545) has recorded how the loss of a cautery, and lacking the boiling oil often used instead, compelled him to dress wounds with a simple paste with immeasurably better results. Later he introduced long and deep incisions to remove balls and other foreign substances as he found this practice more successful in complicated wounds and less dangerous in simple wounds than the method of dilating wounds by means of forceps or other instruments. Wiseman (1719) stressed the importance of early surgery, saying: " In the heat of the fight, whether it be on sea or land, the chirurgeon ought to consider what possibility there is of preserving the limb and, if there is no hope of saving it, to make amputation at that instant whilst the patient is free of fever ".

John Hunter was commissioned as a Staff Surgeon on 30th October 1760, and in 1761 embarked with the British Expeditionary Force which captured Belle Isle. Hunter remained on the island for a year and it was during this time that he made the observations which subsequently formed the basis of his last published work, *A Treatise on the Blood, Inflammation and Gunshot Wounds* (Hunter, 1794), a book which well repays study even to-day for the accuracy of his observations and the clarity of his exposition. However, it appears that it was not then the practice for medical officers to accompany the landing, and most of the cases John Hunter describes had been wounded several hours previously;

he was most impressed by the excellent condition of some wounded French troops who surrendered over a week later, and who had been spared the attentions of the surgeon, and as a result he became convinced that the correct treatment of wounds was conservative, surgery being deferred for at least six weeks, even in cases where amputation was required.

Peace was signed in 1763 and in 1764 Hunter was placed on half pay, but in 1786 he was appointed Deputy Surgeon General and in 1790 he succeeded " bold Robin Adair " as Surgeon General; he completed his work on Gunshot Wounds in 1792, but it was not published until 1794, a year after his death.

The chapters on gunshot wounds form but a small part of the work, which is mainly devoted to a study of inflammation, and one gets the impression that these thirty-year-old notes were added to give advice to surgeons in the war that was so obviously coming against the rising power of revolutionary France.

Guthrie (1824), the leading British surgeon of the Napoleonic wars, observes in his preface: " Previously to the termination of the war in 1815, the opinions of Mr. Hunter on the powers and capabilities of the human constitution were universally received. As general principles they did little mischief but when they came to be acted upon the results were not found to coincide with the principles from which they were deduced "; later he remarks: " Mr. Hunter, whose great talents would have left nothing to be written on gunshot wounds, if he had had the same opportunities for acquiring knowledge on this subject as he had on others and who has erred on a point which may only be decided by personal experience."

Unlike Hunter, who said, " Little has been written on the subject [of gunshot wounds] and what has been written is so superficial that it deserves little attention ", Guthrie had read widely from the works of earlier surgeons, and became convinced of the importance of early surgery. He also studied the works of his contemporaries, and shows familiarity with the works of Larrey and Percy of the French army; he describes most accurately the onset of gas gangrene, and advocates early amputation, but pours scorn on Larrey's theories of aetiology, saying: " He considers the traumatic or humid gangrene as a deleterious principle which is capable of spreading by infection or contagion and is consequently irresistible, a hypothesis which is entirely imaginary, supported by no known principles and invoked apparently to account for a difference which he could not otherwise explain ". One is constantly struck by the way in which earlier writers so nearly reached the conception of infection as a cause for inflammation but at the last moment flinched at the notion of an invisible airborne enemy.

With the impact of Pasteur and Lister and the advent of antiseptic surgery it was believed that the pre-Listerian work was solely of historic interest and only of value as a contrast in its crudity and failure with the successes of modern enlightened times; nevertheless, in 1874 Kocher showed that a bullet fired into a can of water had a bursting effect, and Hugier, cited by Horsley (1894), demonstrated this same effect on human tissues, and Baker (1891) had studied extensively the effects of various missiles used in shooting big game.

However, at the start of the First World War it was thought that all that was necessary was to clean the wound with antiseptic and then suture the " cleaned wound ". The results of this were so disastrous that, in 1916, primary suture was forbidden, and, by 1918, wounds which had formerly been merely opened and drained were now submitted to careful operation and excision, and, in an increasing number of cases, they were closed by " delayed primary " suture or " secondary " suture at the base (*Medical Services, Surgery of the War*, Vol. 1, 1922).

This book and its companion volume form a fascinating and exhaustive compendium on missile wounds, but, although the first 56 pages discuss the physical effects of projectiles at considerable length, the major part concerns the fight against infection and the many methods which were developed to combat this complication.

Early surgery is recognized as the only effective weapon, but primary closure is looked on as the ideal.

The Second World War again showed a return to the errors of 1914, although the methods of missile wound surgery had been further elaborated in the Spanish Civil War (Jolly, 1940) and once more the methods of dealing with missile wounds had to be painfully learnt by experience until the basic essentials of early wound excision and delayed primary suture became universal. In spite of this wealth of recent knowledge, Latta (1951), in his account of the early stages of the Korean war, showed how soon they are forgotten and a mild storm in a teacup resulted (Ogilvie, 1951), culminating in yet one more clear exposition of the essentials (Stammers *et al.*, 1957).

It is unfortunate that only in times of war do many surgeons see enough missile wounds to gain experience, and the lessons so arduously learnt are regarded as being applicable to war surgery only and not applicable to all missile wounds.

The surgery of Internal Security Operations differs from war surgery in that the number of casualties is relatively small, and there is no necessity for further evacuation after initial surgery; such operations provide ideal conditions to study the surgery of missile injuries freed from the logistical considerations of war, and it is felt that, by describing the treatment of the

missile injuries sustained in the recent disorder in Cyprus it may be possible to show how the experience of war may guide us in dealing with the occasional missile wound seen in peace.

Before proceeding to a consideration of these cases let us examine the differences which distinguish a missile wound from other trauma.

The use of high speed radiographs and the high speed kinema have enabled us to study the effect of projectiles on tissues in much greater detail (Piédelièvre and Michon, 1956). Missiles travelling at speeds greater than sound are preceded by a conical bow wave, or, in the case of projectiles of irregular shape, multiple waves. This pressure wave bursts open the tissues causing an outward bulge before the missile enters the body, and, at the points of exit, a "glove finger" phenomenon as the tissues are forced apart in front of the projectile. Immediately after the entrance of the projectile the entrance wound has a diameter considerably larger than the missile, and the diameter of the track may exceed the calibre of the bullet by as much as thirty times (Silliphant and Bayer, 1956). When the missile speed exceeds 4,000 f.p.s. actual explosion of the tissues occurs and the enlargement of the track continues after the passage of the bullet; later the tissues rebound and the track closes and it is at this stage that tearing of the tissues occurs. Owing to differences in the density of the tissues, swerving of the missile often takes place, and the lesion increases in severity in proportion to the angle between the incident trajectory and the final path of the missile. Both muscle and liver behave as fluid systems and actual splash-back at the entrance wound is observed. All these effects are increased by the propensity of missiles to exhibit yawing and tumbling in flight.

What is the clinical significance of these experiments? It is that this surrounding damage, this concussive effect, must be taken into account in any consideration of missile injuries; to quote Hunter once more, "There is most commonly a part of the solids surrounding the wound deadened, as the projecting body forced its way through these solids, which afterwards is thrown off in the form of a slough, and which prevents wounds healing by first intention. From this circumstance of a part being deadened, a gunshot wound is often not completely understood at first, for it is, in many cases, impossible to know what parts are killed, whether bone, tendon or soft parts, till the deadened part has separated."

This report covers almost the whole period of the Cyprus emergency, and describes the methods of treatment used, with particular attention to those methods evolved in war surgery which are equally applicable to missile injuries seen individually in peace. Most terrorist incidents involved from one to five victims, but on occasions double figures were reached. The worst of these was on 30th May 1956, when a bomb was

thrown into a vehicle carrying 21 soldiers and the vehicle subsequently caught fire, all the occupants receiving severe injuries and burns, two succumbing to their injuries before admission.

The weapons used were mainly bombs, made by filling lengths of iron piping with blasting powder stolen from the mines, but pistols, tommy guns, shot guns and even stones accounted for some of the injuries (see Table I).

TABLE I

	Terrorist Activity	*Accidental and Self-Inflicted*	*Total*
TOTAL ADMISSIONS ..	491	213	704
Type of weapon			
Bomb	256	8	264
Rifle	34	84	118
Pistol	76	54	130
Submachine Carbine	67	60	127
Mines	40	—	40
Others	18	7	25

Before describing the treatment of these cases in hospital, it is worth briefly considering the first aid and evacuation of the wounded.

Unlike organized warfare, it was impossible to ensure that casualties were collected by trained teams and often the only immediate assistance was unskilled. Certain common errors in first aid were (i) the administration of fluids by mouth (the tradition of hot, sweet tea dies hard); this necessitates stomach lavage before anaesthesia, a distressing procedure for a shocked and apprehensive patient. (ii) Inadequate splintage of fractures, particularly those of the femoral shaft; there is no doubt that a well applied Thomas's splint controls blood loss into the tissues and thus the degree of shock, and ensures that the patient arrives in the best possible condition for definitive surgery. (iii) Incorrect positioning and inadequate attention to the airway in unconscious patients; it was by no means uncommon for head wounds to arrive supine on the stretcher with obstructed airways and in advanced hypoxia. (iv) Oversedation; pain is not a marked feature of missile injuries and circulatory collapse often prevents the assimilation of intramuscular morphia so that the dose is ineffective until resuscitation when severe respiratory depression may occur under anaesthesia.

Evacuation by helicopter was extensively employed and this method of evacuation has effected a revolution in the transport of wounded. Cases which would have arrived shocked, moribund or dead after a road journey of several hours arrived in excellent condition. It is difficult properly to assess the numbers who owed their lives to this method of transport,

but reference will be made later to some of the problems with which the surgeon is faced when receiving cases who would almost certainly have died had this method not been available.

Resuscitation. Blood loss was estimated by the methods of Grant and Reeve (1951) and in all cases where it was thought that more than one pint had been lost, dextran infusion was started as soon as blood had been withdrawn for cross matching, and blood substituted as soon as it was cross-matched. As many cases were received whilst still in the vaso-constrictive phase it was not uncommon to find that the blood pressure was normal, but this did not deter us from replacing blood. If blood loss had been severe, unmatched Group " O " was administered.

Arterial transfusion was used on one case, but in our experience the disadvantages outweighed the advantages, as, by using two transfusions and the Martin's pump, it was possible to give a pint in three to five

TABLE II

	Terrorist Activity	*Accidental and Self-Inflicted*	*Total*
TOTAL ADMISSIONS ..	491	213	704
Region affected			
Head	79	29	108
Eye	10	3	13
Chest	75	26	101
Abdomen	63	21	84
Buttocks	38	3	41
Joints	17	15	32
Bones	67	43	110
Peripheral Nerve ..	10	4	14
Vascular Injuries ..	13	3	16
Flesh Wounds ..	220	83	303

(Multiple wounds appear once under each region. Multiple injuries of one region are recorded as one case only)

minutes, one case, a wound of aorta, receiving 25 pints in under two hours. Provided that a normal response to transfusion was obtained, operation was deferred until the patient was satisfactorily stabilized with a blood pressure of over 100 mm. mercury, good pulse volume and colour; but if failure to respond suggested continued haemorrhage, then immediate operation was performed. It is felt that it is essential to restore a normal blood volume within four hours of wounding, in order to avoid renal ischaemia and anuria, and we were successful in avoiding this complication in the cases under review, although it was met with in some severe burns not forming part of this series.

The operative treatment will be considered regionally (see Table II).

Head wounds

108 cases: 38 brought in dead, 17 deaths, 6 postoperative deaths.

Head wounds seldom cause severe shock, and when the patient was conscious did not present much difficulty. Careful assessment of the injury, with full neurological and radiological investigation, was followed by induction of anaesthesia, full scalp shaving and careful excision of the wound.

Sufficient bone was removed with nibblers from the skull defect to allow damaged brain and indriven bone fragments and foreign bodies to be gently removed by irrigation. In some of the earlier cases formal craniotomy was performed, but it was found that the degree of damage in conscious cases was not sufficient to warrant this more extensive procedure. Haemostasis was secured by diathermy and fibrin foam, the dura closed, with a fascial graft if necessary, and the scalp closed in two layers. These cases form an exception to the two-stage procedure for missile wounds; it is tentatively suggested that the tautness of the scalp attachments, the relative lack of muscle and the good vascularity are pertinent points in allowing this exception.

In the unconscious patient, however, the primary requisite is provision of a clear airway, and, if the patient's oxygenation was in any doubt, a tracheotomy was performed under local anaesthesia as soon as possible; this procedure was adopted almost routinely. A stomach tube was passed and left *in situ* after lavage; this prevented vomiting, with the concomitant danger of aspiration, and also allowed for intragastric drip fluid replacement which is preferable to intravenous route in these cases. A Foley self-retaining catheter was passed, as restlessness is often caused by a full bladder, and accurate measurement of urinary output is required as an essential part of management.

If these measures lead to an improvement in the patient's condition then immediate surgery is not called for, and excision of the wound with craniotomy may be deferred, under antibiotic cover, for as long as 24 hours until the patient's condition is established.

If deterioration continues then either irrecoverable brain damage is present or intracranial haemorrhage is continuing. In the absence of localizing signs or unequivocal signs of raised intracranial damage the distinction is not easy, and craniotomy is justified to determine which of these two conditions is present. All the deaths (postoperative) in this series were in cases of this sort.

Illustrative case

Rifleman K. Sustained a rifle bullet wound of head due to terrorist activity. Entry wound in the right supraorbital region, bullet palpable below the right mastoid process. Deeply unconscious, with distressed respiration on admission after helicopter evacuation,

approximately half an hour after wounding. An immediate tracheotomy was performed and some improvement occurred which was not maintained. Craniotomy revealed extensive brain damage involving the lateral ventricle with copious haemorrhage; blood was replaced in the theatre and the haemorrhage controlled. Debridement was carried out, but the patient died in the theatre before completion of the operation. This case had both severe haemorrhage and extensive brain damage, the latter masked by the former and only discovered at operation.

A further quotation from Hunter is pertinent;

" Wounds leading into the different cavities of the body are very common in the Army and in a great measure peculiar to war. These wounds become more or less dangerous, according to the mischief done to the contents of the cavity into which they penetrate . . . for very often nothing can be done for the patient under such wounds."

Chest wounds

101 cases: 51 brought in dead, 2 deaths, postoperative deaths nil.

The treatment of chest wounds is principally concerned with the treatment of haemothorax and the subsequent expansion of the damaged lung. Sucking wounds and tension pneumothorax are, of course, matters of urgency, but their treatment is straightforward. Sucking wounds were temporarily dammed with a large pad and bandage or by temporary suture, and, after induction of anaesthesia and intubation, the wound was carefully excised and the muscle layer and pleura closed. In low velocity bullet wounds an exception was made to the rule of delayed primary suture (*vide infra*) and skin closure with subcutaneous drainage carried out; occasionally, when closure of the pleura was impossible, skin closure was used to seal the chest; wound breakdown usually occurred but without recurrence of the sucking.

Tension pneumothorax was treated as a temporary first aid measure by insertion of a needle connected to a rubber tube with underwater seal drainage, but at operation the needle was replaced with an intercostal self-retaining catheter with underwater seal.

In the absence of tension pneumothorax and sucking wounds, our treatment of wounds of the chest was conservative, being limited to excision of the wound and aspiration of the haemothorax. The haemothorax was aspirated every other day with radiological control, until a dry tap was obtained and X-ray confirmed the absence of fluid and full expansion of the lung.

In two cases the haemothorax had clotted and decortication was required, in one of these an apical underwater drain was not employed and as a result the apex failed to expand; there is no doubt that apical drainage with suction should be employed after thoracotomy for missile wounds. The case described below presented an exception to the above

measures as the lung damage was so severe that pneumonectomy was required. Usually cases of this severity succumb before reaching the surgeon, and this was the first in the writer's fairly extensive experience of war surgery where this procedure was called for; this also accounted for the two deaths, both dying shortly after admission from injury to the great vessels.

Illustrative case

Cornet W. Admitted twenty minutes after sustaining six accidental machine gun bullet wounds at point blank range, one through the left hand, one through the left shoulder and four through the chest with large exit wounds over the left scapula and in the left renal area. The patient was *in extremis* when admitted, pulseless and with no recordable blood pressure thirty minutes after wounding, but an immediate transfusion of 5 pints of uncrossmatched group O blood rendered him fit for operation. The exit wound in the left loin was first explored as the major haemorrhage was from this. The spleen was completely disorganized and was removed, but severe haemorrhage continued through a large rent in the diaphragm. Through this tear it was possible to palpate the left lung, which was virtually in ribbons, so a thoracotomy was performed and the lung removed. The damaged muscles around the exit wounds were excised and the wounds closed, a Tudor Edwards drainage tube being incorporated in the lower wound, where the muscles only could be brought together. The hand wound was excised, but the patient's condition did not permit a primary suture. Two days later, when his condition had much improved, the hand wound was sutured and the posterior loin wound closed, intercostal drainage being substituted for the large Tudor Edwards tube. He continued to improve and the thorax appeared dry, the drainage being sterile, so, one week after operation, the tube was removed. An effusion then recurred and this was found to contain a coagulase positive staphylococcus sensitive to streptomycin, aureomycin and chloramphenicol. In spite of repeated aspiration and administration of antibiotics, the effusion thickened into an empyema.

The posterior wound broke down and the empyema discharged through this, but by now the mediastinum was fixed and no untoward results followed the developments of the pleural fistula; his condition rapidly improved and he was evacuated to the United Kingdom on 8th July, where definitive surgery for the closure of his fistula was later performed.

This exceptional case illustrates several points, firstly the extensive damage done within the chest by a high velocity bullet with its blast effect, secondly the rapidity of evacuation to the surgical centre and the immediate replacement of blood was life saving in that it made him fit for surgery and, thirdly, although the late complication of infection occurred, the patient's condition gave no cause for anxiety after the first day. It will be seen from the figures that chest wounds are the most fatal, over 50 per cent. being brought in dead, but even in the severe case described, if resuscitation and surgery are promptly applied, recovery is the rule and no chest case died postoperatively.

Abdominal wounds

84 cases: 11 brought in dead, 10 deaths, 8 postoperative deaths.

In 48 cases, injury to the abdominal organs was found; in five of these injury to the great vessels had occurred, and three died on the table; two died from injury to the ileus, one from reactionary haemorrhage and autodigestion due to pancreatic injury and two from cardiac arrest.

The treatment of abdominal injuries followed orthodox lines, viz. resuscitation and gastric aspiration followed by laparotomy. At operation haemostasis was first secured, then a systematic search of the intestinal

tract made, any perforations found being marked with artery forceps. Then the perforations of the stomach were closed, intestinal perforations closed, unless the viability of the gut was in doubt or absent, when resection was used.

When resection was necessary the resected portion was extended to include nearby perforations as well. The large intestine was treated by mobilization and exteriorization, the perforation forming a colostomy, except for lesions of the rectum, when a proximal defunctioning colostomy was performed and the perforation closed. Postoperatively, continuous gastric aspiration was employed with the administration intravenously of 1 litre of normal saline daily and 1 litre of isotonic glucose on the first postoperative day (2 litres in hot weather) and 2 litres subsequently (3 in hot weather). No potassium was administered until the fifth postoperative day, when, if bowel function had not recommenced and if the urine output was satisfactory, 4 grammes were given daily. At one time attempts were made to measure the aspirate and estimate the electrolyte loss, but the results were usually misleading and it was found better to be guided by the patient's general condition and the urinary output. If peristalsis had not returned by the fifth day we had originally done biochemical investigations and continued to use parenteral replacement, but experience showed that the distinction between obstruction and paralytic ileus in the postoperative missile wound case is extremely difficult, and latterly we embarked on a more active policy, two such cases being reopened, and in both obstruction was found and relieved.

Illustrative cases

(1) *Telegraphist P.* Admitted after being accidentally shot with a pistol cal. 38, the bullet entering the right hypochondrium close to the midline. He had collapsed immediately on being shot and was evacuated by helicopter. Transfusion of three pints of blood raised the blood pressure by 110 mm. of mercury, and laparotomy was performed. On opening the abdomen torrential venous haemorrhage occurred, which was controlled by pressure, and about 4 pints of blood removed from the abdomen. Transfusion was speeded up and the haemorrhage was eventually traced to a rent in the inferior vena cava just below the diaphragm. The rent was closed by approximating the edges with four pairs of 7-inch artery forceps without appreciably constricting the lumen. It was clear that any attempt to suture the rent would further narrow the lumen and, as attempts to suture the vena cava in similar wounds had been unsuccessful because of the friability of the recently traumatized and thin walled vessel, so after a careful search for other intraperitoneal damage, which was fortunately absent, the incision was closed, leaving the handles of the forceps protruding. Next day the patient's condition was excellent and on the fourth day after operation the forceps were removed without further haemorrhage. Recovery was uneventful and he was evacuated to the U.K. as a walking case fourteen days later. Only one other successful repair of inferior vena cava has been traced in the literature, and this was below the renal veins (Angeres, 1955).

This case illustrates the feature of severe venous intraperitoneal haemorrhage, viz. an immediate loss of blood with resultant collapse, but when the peritoneal cavity fills sufficiently to control the haemorrhage then restoration of the blood volume rapidly restores the patient's condition. Opening the abdomen leads to a recurrence of the haemorrhage and in all such cases one must be prepared to replace blood rapidly in the theatre; this case received 8 pints in all.

(2) *Case No. 5. Mrs. R.* Admitted after attempted assassination by a terrorist when she was shopping. Sustained four pistol bullet wounds, the entry wounds being in the right buttock and thigh posteriorly, with one bullet palpable anteriorly in the thigh. She had, however, certain features similar to the case above in that she collapsed immediately and was admitted grossly shocked shortly after injury, with signs of intraperitoneal haemorrhage. Radiological examination revealed a bullet lying in the region of the spleen (it was subsequently discovered that two of the wounds were inflicted whilst she was standing and two whilst lying on the ground, accounting for the approximately horizontal direction of one pair as opposed to the almost vertical track of the other two, one of which had been deflected into the back by the ilium whereas the other had traversed the abdomen). After resuscitation the abdomen was opened and found to be full of blood; the bullet was, however, lying free in the peritoneal cavity near the intact spleen. Brisk haemorrhage continued which proved difficult to locate, the iliac vessels first suspected being intact, but the source of the bleeding was eventually traced to the inferior mesenteric vein, which had been divided by the bullet. The cut ends were ligated, and the abdomen mopped out, no further bleeding being noted. As the blood loss has exceeded replacement the operation was discontinued until adequate blood had been given, and then the gut was examined. Twelve holes were found in the jejunum, there being no further injuries, but one pair of holes had so devitalized a segment of gut that resection was required and, as eight holes were in the same loop of about 9 inches, the whole section was excised and end-to-end anastomosis performed. The two remaining holes were closed by interrupted Lembert sutures, and the abdomen closed. Paralytic ileus persisted for four days postoperatively, then peristalsis recommenced, but some abdominal pain persisted.

Thirteen days after operation, however, the patient suddenly developed intestinal obstruction, with a partial dehiscence of her abdominal incision; the abdomen was reopened and an adhesion from one of the jejunal perforations was found to be trapping a distended loop of bowel and the upper part of the small intestine was filled with soft pultaceous matter. The adhesion was divided and the jejunum opened, a quantity of apple pulp being removed; it was subsequently discovered that the patient had surreptitiously consumed about two pounds of apples brought to her by a visitor. The jejunum was closed and the abdomen sutured. Recovery was surprisingly uneventful and she was discharged fit four weeks after the second operation. At the second operation no evidence of vascular insufficiency due to the ligation of the inferior mesenteric vein was noted, and the intestinal anastomosis was soundly healed.

Wounds of the buttock

41 cases: 2 deaths, both postoperative.

Wounds of the buttock are important since they are common (6 per cent. of all cases), often extensive, and present problems of treatment and nursing. The first and vital factor is to identify or exclude injury to the pelvic organs, and catheterization and rectal examination are mandatory. Even when rectal damage is excluded, a colostomy should always be considered in any extensive buttock wound as a means of preventing soiling of the wounded area, and colostomies were performed on five of the above cases, the wounds in the other cases not being so located that faecal soiling was likely. Careful excision of the wound with haemostasis was performed at the primary operation and when delayed primary suture was practicable it was performed, but where skin loss was extensive postage stamp grafts were applied and the patient nursed prone with the grafts exposed to the air so that a crust of serum formed and kept the grafts in position. This method was found to give a much more successful " take " than any method of occlusive dressing applied to the buttocks.

Once more, no originality can be claimed for this method, for as John Hunter said, " Many wounds ought to be allowed to scab . . . if the whole can be made dry it will preclude inflammation and suppuration which, in most cases, should be avoided if possible. This practice is the very best for burns and scalds."

The two deaths in this series both had extensive wounds with almost complete destruction of the buttocks, one also lost his left arm and leg and died a few hours after operation, the other had a gross spreading pelvic haematoma, noted at colostomy and laparotomy for suspected intraperitoneal injury, and died of paralytic ileus six days after injury; this case also had a chest wound with haemothorax but this was not considered a contributory cause of death.

Joint injuries

32 cases: deaths nil.

Apart from the few cases where a missile opened the joint capsule only, all these cases had associated bone damage, but joint involvement presents its own special problems and is discussed separately. If recovery of joint function is to be secured it is essential that the joint is closed at the primary operation, and in order for this to be obtained without risk of infection the most meticulous wound toilet must be carried out. When all dead, damaged or soiled tissues have been removed and the joint gently cleaned with saline lavage, the capsule is carefully closed; penicillin is then instilled into the joint with a needle and syringe from the unaffected side and this serves as a test of closure as well as a prophylactic against infection. If complete closure of the joint is obtained the joint is splinted, either with plaster of Paris or by means of a Thomas's splint, and closure of the skin is performed in the usual way four to seven days afterwards. In knee wounds immobilized on a Thomas's splint the joint was aspirated at 48 hourly intervals through healthy skin and penicillin instilled. When capsular closure could not be obtained skin suture was employed with relieving incisions or even a swinging flap to ensure absence of tension; this must be regarded as a second best method only to be employed when capsular closure is impossible.

Illustrative cases

(1) *Leading Aircraftman W.* Wounded when motorcycling—he failed to hear a challenge from a sentry who opened fire with a submachine carbine.

A bullet entered into the left popliteal fossa, passed through the lateral femoral condyle, splitting it, and remained impacted in the upper end of the tibia. The split femoral condyle had acted as a secondary missile and made a large wound on the outer side of the knee. At operation the damaged tissue was excised, and the bullet extracted from the tibia through a burr hole in the anterior cortex. Capsular closure was impossible, so skin closure was effected by swinging a flap over the exposed condyle. Penicillin was instilled into the joint, no leakage occurring at the suture line, and the leg immobilized on a Thomas's splint. On the fifth day postoperatively the wound was

re-examined in the theatre, and the swelling had reduced sufficiently for delayed primary closure of the raw area left when the flap was swung over the condyle to be undertaken. Recovery was uneventful, and after three weeks skin traction over the foot of the bed was substituted for the Thomas's splint and knee movements encouraged.

(2) *Gnr. R.* Travelling in a Land Rover when an electrically detonated mine was exploded beside the vehicle. His left elbow received the full brunt of the explosion and was shattered, the lateral epicondyle being broken and exposed and the radius and ulna both fractured, the ulna into four fragments, whilst the head and neck of the radius was lying free in the wound which involved the whole posterior and lateral aspect of the forearm from above the olecranon to four inches above the wrist. No movements of the hands were possible, but sensation and circulation were intact. The wound was so extensive and the damage so great that amputation appeared inevitable, but at operation, after trimming of the skin edges and wide excision of damaged muscle, during which the radial nerve was seen to be intact although muscle all around it had to be excised, it appeared feasible to attempt to save the limb. The head and two inches of the radius was removed and the joint capsule closed. The limb was then dressed with carbonet gauze and dry dressings and immobilized in plaster.

Five days later, much to our astonishment, it proved practicable to perform a delayed primary suture. As the forearm was completely unstable, a Kirschner wire was passed through intact skin over the olecranon and the fragments of ulna threaded on it like beads on a string before skin closure, and after suture the limb was immobilized in a position of function.

Three weeks later, although his general condition was excellent, some soiling of the plaster was observed, so the plaster was removed in the theatre when it was found that a small area only of the suture line, over one of the ulnar fragments, had broken down. All stitches were removed, the upper end of the wound over the elbow joint being soundly healed, and the exposed ulna dressed and the arm reimmobilized. The arm was re-examined under anaesthesia at three-weekly intervals and serial X-rays taken. Three months later the wound was almost closed and union had occurred in the ulnar fragments with cross union of the radius. The ulnar fragment which was visible in the base of the wound had not sequestrated entirely, only a small portion of the posterior cortex underlying the wound showing evidence of necrosis and radiological separation, so the wire was withdrawn. Some 45 of movement was obtained at the elbow. Plaster was reapplied and he was evacuated to England; the sequestrum was not removed as separation was not complete. This case illustrates the importance of joint closure as, although infection developed in the wound distal to the joint, the latter was not involved and a very good degree of recovery was attained. It also illustrates the importance of saving an innervated and non-ischaemic hand even when the injury above is vast.

Bone injuries

110 cases: 3 brought in dead, 1 death, postoperative nil.

Missile injuries of bone differ from the compound fractures seen in civil life in that the fracture is caused by a high velocity missile striking the bone with sufficient violence to break it, and this violence is usually sufficient to convert fragments of bone into secondary missiles which inflict further injury. This in turn gives rise to severe haemorrhage and oligaemic shock, hence the evil reputation of the G.S.W. of femur. Adequate first aid splintage, prompt and smooth evacuation and speedy transfusion therefore form the cornerstones of preoperative treatment.

These measures were in general applied during the period in question although inadequate splintage was occasionally seen. Helicopter evacuation often minimized the ill effects of this omission, but there is no doubt that time spent in adequate first aid splintage is amply repaid and avoids

the delay occasioned by the prolonged resuscitation often needed in the unsplinted case. If an unsplinted case was admitted, adequate splintage in reception before transfer to the ward was insisted upon and preceded transfusion. After resuscitation operative treatment consisted of wound excision and splintage with occlusive dressings. Delayed primary suture was performed, and, if this was impracticable, full thickness flaps were used to cover the bone, the resultant soft tissue defect being covered by split skin grafting.

Illustrative case

Case No. 8. *Police Constable H.* Wounded by a bomb, which exploded at his feet. The left leg was completely shattered below the knee, with a devitalized foot, there were multiple small bomb wounds of the left thigh, with a compound fracture of the left femur and left tibia and fibula. Below-knee amputation of the left leg was performed, the circular flap being left unsutured. The wounds of both thighs and right leg were excised, and a Tobruk splint supplied to the right leg. Check X-ray showed the position to be satisfactory, and on the fifth day the Tobruk splint was windowed sufficiently to allow delayed primary closure of the wounds; the wounds of the left thigh and the amputation were also sutured. Check X-ray showed that the reduction had been maintained, so, after removal of the stitches, the Tobruk plaster was completed and used as a definite form of treatment. Union progressed uneventfully and after ten weeks there was ample evidence of union, so that he was evacuated for limb fitting in the U.K.

This case illustrates the advantage of attempting early reduction, when muscle relaxation following the extensive soft tissue injury permits easy manipulation without the skeletal traction usually needed in closed injuries. It also stresses that the Tobruk splint, although designed primarily as a means of transport is, if properly applied, a suitable form of definitive treatment.

Peripheral nerve injuries

14 cases: no deaths.

The policy with these was to defer the repair of the nerve until after wound healing, so, when noted at the primary excision, the ends of the nerve, if readily identified, were apposed by a single black silk suture, to assist at later identification. No extensive search was carried out if the ends could not be found as the primary requisite is wound healing to allow accurate nerve suture at about three weeks after injury when the extent of damage to the nerve is readily defined. In view of the long follow-up required cases were then transferred to the United Kingdom.

Illustrative case

Case No. 9. *Civilian G.*, a youth of eighteen, son of a Warrant Officer, was walking with two friends when they were waylaid by two terrorists armed with shotguns. One friend escaped but the patient and his friend were shot from behind at close range, the latter being killed; but G. feigned death until nightfall, when he crawled to a hut, the occupant of which, however, refused assistance. G. was later found by a patrol and sent to hospital. On admission he was moderately shocked with an extensive buttock wound and a complete sciatic nerve paralysis on the left side.

After resuscitation with three pints of blood his condition had improved remarkably and wound excision was carried out. There were multiple superficial pellet wounds, but

the bulk of the shot was still contiguous when it hit this patient and had inflicted considerable damage to the glutei and had partially divided the sciatic nerve, numerous pellets being removed from the vicinity of the nerve.

Delayed primary suture was carried out on the fifth day and healing was uneventful, some recovery in sensation being noted before his evacuation to England.

He later returned to Cyprus to give evidence at the trial of his assailants, and, without further surgery, had recovered except for a foot drop and lateral popliteal palsy. This case illustrates that partial neurotmesis in missile injuries is accompanied by complete neuropraxia, and that the partial continuity of the nerve, if observed at the primary operation, is a most valuable finding, influencing the prognosis and the subsequent treatment.

Vascular injuries (excluding abdominal and thoracic)

16 cases: 1 death.

Repair of vessels traumatized by missiles is seldom practicable, as, if the collateral circulation is insufficient, the vitality of the peripheral tissues is already so impaired that it is too late to attempt restoration of vascular continuity, especially as the damage to the vessel extends usually over a considerable segment, and there is also the associated tissue damage to be taken into account. In this series only three cases had circulatory deficiency, all the others having adequate collateral circulation so that ligature of the divided vessels was the treatment adopted. One of the three had in addition to a divided femoral artery an extensive buttock wound and a fractured femur on the same side. At operation the artery was ligated and the wounds excised, but on the day after operation it was apparent that the leg was dead and the limb was amputated. His condition continued to deteriorate and he died the next day, a post mortem revealing multiple cerebral haemorrhages and other evidence of cerebral hypoxia, so death may have been due to the period of preoperative shock (he had been some hours without splintage and exsanguinated, and the blood pressure had been unrecordable on admission); however, earlier amputation might have been life-saving.

A second case had division of the popliteal vessels with obvious death of the foot; below knee amputation was performed, and the flaps left open for delayed primary suture, which was successful. In only one case was arterial anastomosis attempted.

Illustrative case

Gnr. B. Accidental 38 pistol wound of axilla, the arm being ischaemic and pulseless on admission about half-an-hour after wounding. His general condition was excellent and after crossmatching the wound was excised and extended over the line of the brachial artery and into the axilla. The divided artery was located easily and was a fairly clean division with retraction of the upper end and little bleeding; the spasm of the artery was quite remarkable. After freeing and trimming the divided ends, anastomosis was performed by Filaton's method and pulsation felt in the distal part.

Next day the hand was warm but the radial pulse was no longer palpable, nor had it returned when the wounds were healed and he was evacuated. Unfortunately no angiogram was possible in Cyprus and no follow-up received, but it is thought probable

that the anastomosis did not remain patent, otherwise the pulse should have remained; however, one may hazard a guess that continuity remained over a critical time whilst collateral paths were being established.

Flesh wounds

303 cases: no deaths.

In speaking of flesh wounds we are sometimes apt to overlook the fact that flesh and muscle are synonymous terms, and it would be better to think of these wounds as muscle wounds.

The importance of decompressing swollen muscle has recently been stressed in articles on the anterior tibial syndrome, and the experimental work on missile wounds quoted above has confirmed the earlier clinical observations on the extensive trauma around the track of a projectile.

In spite of this it is still widely believed that the method of dealing with these wounds by excision and delayed primary suture is only applicable to war surgery because of the saving of time at the primary operation and the possibility of evacuating the patient shortly after surgery if sutures are not used. Whilst it is true that these two advantages apply to delayed primary suture, there are two greater benefits.

The peculiar nature of a missile wound gives rise to damage at a distance from the actual track of the missile; this leads to effusion and haemorrhage. If primary suture is employed the swelling which ensues leads to tension and this in its turn, particularly in muscle, leads to ischaemia and necrosis. All missile wounds are contaminated and potentially infected so the presence of blood clot and dead tissue provides the ideal pabulum for suppuration. At the primary operation, therefore, obviously dead skin was excised but otherwise incision of skin rather than excision is the correct description of the procedure; all damaged subcutaneous tissues and muscle were excised until healthy bleeding tissue was reached; bone fragments, if attached and not grossly soiled, were preserved, but metallic foreign bodies were removed if accessible. Far more important is the removal of secondary missiles such as particles of clothing, splinters, grit or dirt which may be present, and to do this the exposure of the wound must be adequate. These incisions must include the deep fascia and in the limbs are preferably longitudinal.

Haemostasis was then secured as far as possible, but the catchword of "absolute haemostasis" is hardly applicable to the larger wounds involving much muscle. At this stage it was found interesting to see if primary closure would be possible without tension as in over half the cases where primary closure would have been impossible delayed closure proved successful, showing the degree of swelling which had already occurred. The wound was then covered with jellonet, a loose mesh non-adherent dressing, and several layers of gauze, then wool and an occlusive bandage.

Limb wounds, if severe, but even if there were no fracture, were splinted with plaster of Paris slabs bandaged on without tension. Four to seven days later the patient was anaesthetized and the dressings removed in the theatre; blood clot was gently removed and the skin edges freed from their adhesion to the underlying tissues using the handle of a scalpel. If necrotic tissue was present it was excised and the wound redressed for suture two days later, but in nearly all cases the wound was clean and dry so the skin was sutured, drainage only being employed if there was a cavity. If suturing without tension was not feasible, then partial suturing was employed, the raw areas being covered with split skin " postage stamp " grafts. A Cramer wire " cage " was then formed over the grafted wound, leaving the wound exposed to the air, and the patient returned to the ward.

Using this procedure, primary healing occurred in 97 per cent. of cases and the modal stay in hospital for these was 14 days if delayed primary suture was used and 23 days if grafts were used in addition.

Multiple wounds

In over 10 per cent. of cases the wounds inflicted were multiple and in some the wounds were so extensive and severe that treatment had to be modified considerably because of the conflicting demands of each injury. In seven of the eighteen postoperative deaths recorded above there were multiple wounds and, although for purposes of comparison they have been listed under the region whose injury ultimately led to death, the presence of other injuries probably contributed to the fatal outcome. It is of vital importance to assess correctly which injuries are immediately endangering life, and to plan the operative approach so that these are dealt with as speedily as possible. Unless grave intraperitoneal haemorrhage is suspected a laparotomy should be performed after any lesions of the posterior aspect have been dealt with, as turning after laparotomy is very upsetting to the patient. Resuscitation must be adequate and often requires more blood than a sum of the individual wounds would seem to indicate.

Illustrative case

L/Cpl. H. Wounded in a terrorist attack on a vehicle, sustaining bomb wounds of abdomen, chest, buttock, thighs and feet with a compound fracture of the right femur and extensive burns of face, hands, knees and arms. After resuscitation the buttock wound was first excised as the removal of grossly traumatized muscle is of the greatest importance; the thigh wounds were then excised and a Tobruk splint applied after cleaning the burnt area of the right knee; the abdomen was then opened and it was found that only the liver was damaged. The chest wound was then excised and the muscle wall sutured as the pleura could not be closed. The foot wounds were trivial and were left alone.

Owing to the femoral and abdominal wounds aspiration of the haemothorax was inadequately carried out and he subsequently had to have a decortication and extensive grafting for his burns, but he was finally evacuated to the United Kingdom in reasonable condition.

TABLE III

	Terrorist Activity	*Accidental and Self-Inflicted*	*Total*
TOTAL ADMISSIONS ..	491	213	704
Disposal			
Brought in Dead ..	72	31	103
Died	21	11	32
Evacuated to U.K. ..	111	39	150
Returned to Units ..	287	132	419

Disposal

The disposal of these cases is shown in Table III. Cases unlikely to be fit within three months were evacuated to the United Kingdom and this, of course, included all those likely to be permanently disabled. This rule was interpreted generously for terrorist casualties, and towards the end of the campaign all terrorist casualties were granted home leave; also a number of cases were evacuated because their period of military service was soon ending. The mortality rate for cases alive on admission to hospital was 5.3 per cent. and in those fit for surgery 3 per cent., figures that are remarkably similar to those recorded by Clyne (1954) for Malaya, of 5.5 per cent. and 3.7 per cent. respectively. However, the rates for the different regions are somewhat lower, for example abdominal wounds in this series carried a mortality of 11.3 per cent. against 16.7 per cent. in Malaya and the same figure in Korea (Artz, 1955) and 21 per cent. in World War II (Beebe & De Bakey, 1952). In the first war, figures varying from 80.9 per cent. to 39.9 per cent. were recorded (*Medical History of the War*, 1922), yet Guthrie (1824) records an abdominal wound mortality rate of 23 per cent.

CONCLUSIONS

Developments in the treatment of missile wounds occur during major wars, but there is a regrettable tendency for the lessons learnt in times of war to be forgotten in times of peace, when missile injuries are few, and scattered among many surgeons. It is also unfortunately believed that the methods used in war are not applicable to peace-time conditions. Missile wounds present certain special problems and, in presenting this series, an endeavour has been made to indicate their nature and how they were tackled. No new methods were evolved, but the advisability of decompression and delayed primary suture in wounds of muscle has been stressed.

After two years of war surgery, a feeling of competence and confidence arises, only to evaporate after twenty years' experience of missile wounds, " even if it were only for this reason, that few gunshot wounds are alike, and therefore the same practice cannot apply to all " (Hunter, 1794).

ACKNOWLEDGMENTS

I should like to thank Lieutenant-General Sir Alexander Drummond, K.B.E., C.B., Q.H.S., F.R.C.S., D.L.O., LL.D., and Robert Cox, Esq., M.B.E., F.R.C.S., for their interest and encouragement; also Brigadier Marsden, C.B., Q.H.S., F.R.C.S., Consultant Surgeon, Middle East Land Forces, for his invaluable assistance and advice in many of the problems encountered. I should also like to express my indebtedness to the nursing officers, medical officers and nursing staff serving in Cyprus, unfortunately too numerous to name, for their devoted and skilled aid in the management of these cases.

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FACULTY OF DENTAL SURGERY

AT THE RECENT meeting of the Board of the Faculty of Dental Surgery, Professor M. A. Rushton, C.B.E., was re-elected Dean of the Faculty for the forthcoming year, and Mr. G. H. Leatherman was elected Vice-Dean.

The thirteenth annual dinner of the Faculty was held on July 15th and 155 guests were present. Miss Edith Pitt, M.P., Parliamentary Under Secretary to the Ministry of Health, proposed the toast of "The Faculty", and the Rt. Hon. Lord Cohen of Birkenhead replied on behalf of the guests.

A PROTECTIVE AND PERMANENT COVERING FOR PHOTOGRAPHS, DRAWINGS AND DOCUMENTS

by

A. A. SILCOX, A.I.S.T.

Senior Technician, Department of Pathology

SOME YEARS AGO a method was devised in the Department of Pathology for incorporating photographs, X-ray positives, and photomicrographs in the mounting museum specimens (Proger and Silcox, unpublished). The actual specimen was mounted on a Perspex plate and the appropriate illustration placed on the opposite side. This was a relatively simple procedure, the illustration being soaked in chloroform and pressed on to the Perspex plate. Perspex is soluble in chloroform and thus a firm union resulted. When this technique had been in use for a few years it was noted that the illustrations were liable to become discoloured by the fluid in the jar. Accordingly experiments were made to obviate this disadvantage, and the following method enables illustrations to be incorporated in museum jars without any discoloration. It is also suitable for protection of drawings and other documents.

Materials

$\frac{1}{16}$ in. Perspex sheet, white and clear.
*Tensol cement No. 7.
Dry mounting tissue.
Dry mounting press.
Plate glass.
†Double-sided cloth tape.

Method

(1) The Perspex sheets should be cut so that there is at least 1 in. overlap all round.

The white Perspex is given a matt surface by rubbing with glass paper and the photograph is fixed in position with dry mounting tissue, in a mounting press.

(2) Strips of card slightly thicker than the print to be covered are attached with chloroform around the edges of the white Perspex so as to provide a supporting frame for the free edges of the clear Perspex when it is placed in position.

(3) The white Perspex sheet is stuck to the plate glass by double-sided cloth tape to correct any distortion caused by the hot dry mounting press.

* Tensol cement obtainable from Visijars Laboratory Supply Co., Ltd.
† Double-sided cloth tape obtainable from Industrial Tapes, Ltd.

(4) Tensol cement No. 7, prepared and mixed as directed, is poured over the print so as to cover it completely. In our experience 25 c.c. of the mixture is needed to cover 6 ins. × 6 ins.

The sheet of clear Perspex is carefully lowered into position in the manner of a coverslip, taking care not to trap air bubbles.

Surplus cement is removed with a pipette as it is expressed. Care must be taken that the cement does not run under the white Perspex, otherwise there will be a bond between Perspex and glass. A protective wall of Sellotape may be applied around the edges of the white Perspex to avoid this.

(5) The cement begins to set within 30 minutes of mixing, the temperature having risen slightly in the process. The mount may be trimmed and polished the following day.

(6) When trimming, a margin of at least ¼ in. should be left to form a seal, since the paper is not impregnated by the plastic cement.

Photographs mounted by this method are completely waterproof, and are therefore permanent.

The method has been used successfully in the Wellcome Museum in the Department of Pathology for over one year.

SIR WILLIAM COATES, K.C.B., C.B.E., V.D., T.D., C.St.J., F.R.C.S.

IT IS NOT often that one of our Fellows lives to celebrate his own centenary, and it was with great pleasure that we heard that Sir William Coates, who became a Member of this College in 1881 and a Fellow in 1922, had attained his hundredth birthday on 14th June 1960.

The President wrote to Sir William to convey the congratulations and best wishes of the Council of the College, and received a most interesting letter in reply. We have now obtained Sir William's permission to publish this letter as we are sure that our readers will enjoy reading his reminiscences.

The text of the letter is as follows :—

" Your very generous letter conveying congratulations on my hundredth birthday from yourself and the Council of the Royal College of Surgeons has given me very great pleasure. I have in the past received abundance of proofs of the goodwill and kindness of your College. It is true that so many changes and improvements have occurred during my lifetime.

" I was fortunate in my early career in deriving many incentives from those with whom I came in contact. I remember Professor Lister's arrival at King's College, London, and although I was at the London Hospital, I frequently went to watch him operate at the King's College Hospital.

" I remember so well that serious operations were performed by surgeons clothed in dirty old frock coats which were kept stowed away in cupboards in the House

Surgeons' rooms. Nevertheless I learned to admire the teaching of men like Jonathan Hutchinson, Frederick Treves and many others.

"My greatest admiration went to Hughlings Jackson whose House Physician I was for twelve months; I travelled with one of his patients and kept in close touch with him until his death. He was not only a great neurologist but also a philosopher.

"I have never regretted my selection of a profession which has given me so many and abundant opportunities for reflection. I have been totally blind for eight years and suffer other disabilities which keep me confined to my arm chair, but I keep in touch with affairs, especially with many medical friends who keep me informed of the great advances that are almost daily made in my profession.

"I should like to thank you once again for writing to me and sending me your own and your colleagues' congratulations on my attaining my great age."

THE LATE SIR ARCHIBALD McINDOE, C.B.E., F.R.C.S.

THE FOLLOWING LETTER has been received by the President from Dr. Donald C. Balfour, Director of the Mayo Foundation in Rochester, Minnesota :

"My dear Sir James,

"In the last issue of the *Annals* of the College I noted with pleasure that a more personal note was given by Naunton Morgan in reference to his association with Archibald McIndoe, and it occurred to me that, since you undoubtedly are keeping a file of material pertaining to his life and work, you might wish to have a story which supplements the statement which Naunton Morgan made, namely, that 'while on a visit to the Clinic, Lord Moynihan saw the worth of Archie McIndoe and promised him a job in England, in fact in London'.

"It so happens that McIndoe was my first assistant at that time, and we were aware of the scope of his ability and of his indefatigable energy, but we also knew that he had his heart set on ultimately getting to London. He had reached a point in his training here at which he was more than ready to step out on his own, so to speak, and when Moynihan (Sir Berkeley, at that time) was visiting here, I took the opportunity, knowing the above facts, to present McIndoe to Sir Berkeley. The occasion to which Morgan refers took place in my operating room at Saint Mary's Hospital here, on a day on which McIndoe was helping me with some complicated gastric pathologic process; I think it was a gastro-jejunocolic fistula. Suddenly it occurred to me that I could let McIndoe show what a capable surgeon he was. We all knew about his wide knowledge of pathology and medicine, and of his conspicuous work in surgical research.

"When we were embarked on this complicated procedure I whispered to McIndoe: 'Mac, you come over to this side of the table and finish the operation.'

"We changed places, and Moynihan was so impressed with the evidence that McIndoe was doing the job as well as, or better than, I was, that he urged McIndoe to come to London. McIndoe did so and Moynihan set up a preliminary program for him there. It is one of my most vivid memories of McIndoe and of course to him it was the zenith of his hopes.

"The rest of the story has been told very well by those who have written tributes to Sir Archibald, but I thought that this detailing of the incident which Mr. Morgan described might be of some interest to you. I am sending a copy of this to Naunton Morgan and Sir Arthur Porritt, since I know that they will be interested in an elaboration of the incident which they described in the impressive resolution of condolence which they presented at the meeting of the Council in April.

"Yours sincerely,

"DONALD BALFOUR."

ADMISSION TO THE HONORARY FELLOWSHIP

AT THE MEETING of Council on 14th July, Dr. J. William Hinton of New York was admitted to the Honorary Fellowship. In a citation in honour of Dr. Hinton, Professor Ian Aird spoke as follows :

" Mr. President: Dr. J. William Hinton and I went to the same school, the same school that all of us have been to, the school you don't tell tales out of. Every schoolboy—every American schoolboy—knows that the Northern Neck of Virginia, that narrow peninsula between the Potomac and the Rappahamac, 85 miles long and 12 miles broad, is a nursery for heroes—" The Stronghold ". Madison was born at Port Conway, George Washington at Wakefield, and Robert E. Lee at Stratford Hall. On 12th March 1894 James William Hinton was born at Reedsville. He was brought up not far from that town in a farmhouse on the Little Wicomico, sheltered on the east from Chesapeake Bay and the Atlantic by a narrow neck of land. Not far from here the British Fleet on their way to Washington in 1812 passed close to the Potomac shore, and the people of the Northern Neck heard British guns fired in anger. Thirty-five miles away from Reedsville, and a century earlier, Pocohontas thrust her body between John Smith and the executioner's club. From all this you may deduce that Bill Hinton is a Virginian.

Dr. J. W. Hinton

" The Northern Neck was colonized 250 years ago, and it was colonized by Englishmen. From then until a few years ago men have left the Neck to seek their fortune elsewhere, and often to seek it successfully, but there have been no immigrants. Hinton is of unmixed (a Scotsman like myself could never bring himself to use the word " unadulterated " in this connection) English blood. In due course, Hinton went to *the* University, the University of Virginia, graduating Doctor of Medicine in March 1919, and proceeding to the Postgraduate School of New York at Bellevue.

" In 1946 he succeeded Heid as Professor. It is characteristic that during his whole 12 years' tenure he accepted no salary for this post. His generosity was inspired no less by charity than by a thirst for untrammelled freedom of action.

" In New York surgery Dr. Hinton has been an unqualified success.

" In that city there is active competition in surgical practice and Hinton's success in practice there is a measure of his physical stamina. Four hours of sleep used to be enough for him. It is a measure also of his mental stamina, but physical and mental

stamina are not enough to ensure success in surgery in New York. He had to be also a wise and dexterous craftsman. But if stamina and craftsmanship were his only virtues he would not be standing where he is now. His qualifications are based on other foundations, education and ethics. He would not claim, and I would not make the claim for him, achievement in laboratory research. His achievement in clinical research has been substantial, and his work on the pancreas and on cardiac resuscitation have been at least adequate. But it is in education that he has made his mark. He has trained some hundreds of surgeons in Bellevue where, as not universally in America, there are public wards. His services to education are more than technical and they range wide. I do not believe anyone understands more clearly what the medical needs of America are going to be in the next 20 or 30 years and what immense educational expansion they will require.

" In New York no-one has been more influential in maintaining those standards of surgery and of surgical behaviour that the American College of Surgeons demands.

" Bill Hinton will tell you that he is a Southerner. The great Southern American names have been an inspiration to him, but he recognizes that names like Lee and Grant, Washington and Burgoyne no longer arouse passions. Horizons now transcend national frontiers, Anglo-American solidarity is a bulwark of international civilization and not the least important factor in international civilization is a common understanding of surgery. No-one has worked harder or built more surely for Anglo-American surgical amity than Dr. J. William Hinton has. It is right now that he should return to London, and I showed him yesterday Tyburn Place at Marble Arch where stood the tree from which so many of his ancestors so successfully escaped.

" Our ceremony today is incomplete in only one respect, the absence of Mrs. Hinton. We are all very clever fellows, but none of us could aspire to be rated among the first nine lady bridge players of North America, as was Jannett Lord Hinton, Jerez Lord's sister and Bill Hinton's wife. I only wish that we had here with us today the great lady of Easthampton, where all the ladies are great ladies.

" Mr. President, I beg leave to present to you Dr. James William Hinton of New York, Doctor of Medicine of the University of Virginia, for admission to the Honorary Fellowship of this College."

After the President (Sir James Paterson Ross, Bt.) had admitted him to the Honorary Fellowship, Dr. Hinton spoke thus :

" Mr. President, Professor Aird, Members of Council: It is a very great honour that you have conferred on me to-day by admitting me to the Honorary Fellowship of your College. It makes me well aware that there are some surgeons in the United States worthier than I. Standing before you, Mr. President, I am aware of my many deficiencies as a surgeon. By heritage, birth and education, I am a Virginian, and by tradition I will always look to England for guidance. This extended through my medical education. My first full-time predecessor was chosen by Mr. Thomas Jefferson and appointed in February 1826 because of his degree of scientific talent and instruction in correct habits and morals.

" I am indeed grateful to my eminent friend, Professor Ian Aird, for his generous remarks and his short memory. He knows my many weaknesses only too well, and I thank him for forgetting them. I am greatly honoured, Mr. President, that I should receive from you this Honorary Fellowship because you are greatly revered in the United States, as testified by your Honorary Fellowship of the American College of Surgeons and Membership of the American Surgical Association. I am also grateful to the Council for this great honour, and I thank you all."

Professor J. H. Louw, Professor of Surgery in the University of Cape Town, was then admitted to the Fellowship, having been elected as a practitioner of twenty years' standing. After being admitted by the President, Professor Louw spoke :

" Mr. President, Members of Council: Thank you most sincerely for the very great honour you have done to me, and through me to the University of Cape Town and

the South African College, of which I am a Member. I should like to ask you, Sir, whether you would accept this message from our College.

"'The President and Members of the Council of the College of Physicians, Surgeons and Gynaecologists of South Africa wish to extend most cordial greetings to their colleagues of the Royal College of Surgeons of England. It is our desire to maintain warm and friendly relations with your College, and to take this opportunity of offering our sincere good wishes for your continued growth and prosperity.'"

PROCEEDINGS OF THE COUNCIL IN JULY

THE PRESIDENT

At the meeting of Council on Thursday, 14th July, Sir Arthur Porritt, K.C.M.G., K.C.V.O., C.B.E., M.Ch., F.R.C.S., was elected President of the College.

SIR ARTHUR PORRITT was elected President of the College at a meeting of the Council held on 14th July 1960. Sir Stanford Cade and Professor Digby Chamberlain were elected as Vice-Presidents.

A Past President's badge was presented to the retiring President, Sir James Paterson Ross, Bt., who was warmly thanked for his distinguished and devoted services during the past three years.

Sir Clement Price Thomas, Mr. C. Naunton Morgan and Mr. Hedley J. B. Atkins were re-admitted as members of the Council for a further

period of eight years. Mr. Humphrey G. E. Arthure was admitted as a co-opted member of the Council.

Dr. J. William Hinton of New York was admitted as an Honorary Fellow, after a citation in his honour by Professor Ian Aird.

Professor J. H. Louw of Cape Town was admitted as a Fellow of the College by election, and he brought a message of greetings to the Council from the College of Physicians, Surgeons and Gynaecologists of South Africa.

A Resolution of Condolence was passed on the death of Mr. Seymour Barling, past Member of the Council (1935-43) and the Court of Examiners (1939-45).

A Moynihan Lectureship was awarded to Professor J. F. Nuboer of Utrecht, who will give his lecture on 20th October next during the meeting of the International Federation of Surgical Colleges. Dr. W. S. Stiles was appointed Edridge-Green Lecturer for 1960.

The Hallett Prize was awarded to G. V. Shead, of the University of Sydney, on the result of the Primary Fellowship Examination in May-June.

Professors and Lecturers for the ensuing year were appointed as follows :—

HUNTERIAN PROFESSORSHIPS

(Lectures on Comparative Anatomy and other subjects, illustrated by preparations from the Hunterian Collection and other contents of the Museum, by Fellows and Members of the College.)

H. B. STALLARD.—One lecture on malignant melanoma of the choroid treated with radio-active applicators.

C. E. DREW, M.V.O.—One lecture on profound hypothermia in cardiac surgery.

D. P. CHOYCE.—One lecture on the development and uses of all-acrylic anterior chamber implants in ophthalmic surgery.

R. C. CONNOLLY.—One lecture on cerebral ischaemia in spontaneous subarachnoid haemorrhage.

T. J. BUTLER.—One lecture on the effect of gastrectomy on pancreatic function in man.

O. DANIEL.—One lecture on the complications of diversion of the urinary stream.

H. ANNAMUNTHODO.—One lecture on rectal lymphogranuloma venereum in Jamaica.

G. W. MILTON.—One lecture on the behaviour of gastric epithelium under various conditions.

W. B. JENNETT.—One lecture on epilepsy after blunt head injury.

I. RANGER.—One lecture on a study of the functional anatomy of the diaphragm with special reference to the aetiology and treatment of oesophageal hiatus hernia.

F. G. ELLIS.—One lecture on surgical rehabilitation of the rheumatoid hand.

W. F. W. SOUTHWOOD.—One lecture on villous tumours of the large intestine—their pathogenesis, symptomatology, diagnosis and management.

J. K. ROSS.—One lecture on the fate of autogenous tissue grafts in the heart.

J. F. NUNN.—One lecture on the distribution of inspired gas during thoracic surgery.

ARRIS AND GALE LECTURESHIPS

(Lectures on subjects relating to Human Anatomy and Physiology.)

P. H. GOLDING-WOOD.—One lecture on autonomic surgery of the ear, nose and throat.

N. H. PORTER.—One lecture on a physiological study of the pelvic floor muscles in rectal prolapse.

N. G. ROTHNIE.—One lecture on changes in blood coagulation due to perfusion for open heart surgery.

L. TURNER.—One lecture on the structure of arachnoid granulations, with observations on their physiological and pathological significance.

J. C. SEYMOUR.—One lecture on labyrinthine circulatory dynamics.

H. E. LEWIS and J. P. MASTERTON.—One lecture in polar physiology: its development in Britain.

BLAND-SUTTON LECTURESHIP

F. STANSFIELD.—One lecture.

ERASMUS WILSON DEMONSTRATORSHIPS

(Demonstrations on the Pathological contents of the Museum by the Pathology Curator or some other duly qualified person or persons.)

L. BITENSKY.—One demonstration.

D. C. CALDWELL.—One demonstration.

A. R. CURRIE.—One demonstration.

J. B. ENTICKNAP.—One demonstration.

M. S. ISRAEL.—One demonstration.

L. W. PROGER.—One demonstration.

ARNOTT DEMONSTRATORSHIPS

(Demonstrations on the contents of the Museum by the Conservator of the Museum or some other duly qualified person or persons.)

J. DOBSON.—One demonstration.

A. A. BARTON.—One demonstration.

R. McP. LIVINGSTON.—One demonstration.

D. SLOME.—One demonstration.

C. J. STRATMAN.—One demonstration.

D. H. TOMPSETT.—One demonstration.

Examiners were appointed to conduct Primary F.R.C.S. and Primary F.F.A.R.C.S. Examinations in Khartoum and Colombo in January 1961.

The award of a Mackenzie Mackinnon Research Fellowship to Dr. Sidney Kramer was reported.

The Gilbert Blane Medal for 1960 was awarded to Surgeon Captain C. P. Collins, D.S.C., R.N., for his work in connection with the health of employees at H.M. Naval Base, Singapore.

Licences in Dental Surgery were granted to 62 candidates successful at the recent Final Examination.

The following hospitals were recognized under paragraph 23 of the Fellowship Regulations :

Hospitals	Posts Recognized		
	General (6 months unless otherwise stated)	Casualty (all 6 months)	Unspecified (all 6 months)
London— St. Leonard's Hospital Shoreditch (additional)	Surg. Reg.		
Enfield—Chase Farm Hospital (additional)		H.S. (Orth. & Cas.)	
Stafford—Staffordshire General Infirmary (additional)		Cas. Off.	
Farnham Hospital (additional)		Cas. Off.	
Hull—Kingston General Hospital (additional)	Registrar		
London—Whittington Hospital, Highgate (additional)			2nd Orth. Reg. 2 Orth. S.H.O.
Guildford—The Royal Surrey County Hospital (additional)	2nd Surg. Reg. (1st Surg. Reg. to be recognized for 6 months only, not 12 as heretofore)		
Farnborough Hospital and Bromley Group (additional)	3rd Surg. Reg.		
Brighton—Royal Sussex County Hospital (Group Appointment) (additional)			*Under para.* 23 (*c*) 2nd S.H.O.
Isleworth—West Middlesex Hospital (redesignation)			*Under para.* 23 (*c*) E.N.T. Senior Reg. redesignated as Reg.
Chesterfield—The Chesterfield and North Derbyshire Royal Hospital (additional)	S.H.O.		
Crewe and District Memorial Hospital (additional)		S.H.O. (Cas. & Orth.) *Redesignation* S.H.O. now becomes J.H.M.O. (Cas. & Orth.)	
India—Safdarjang Hospital, New Delhi (additional)			*Under para.* 23 (*c*) E.N.T. Reg.

OVERSEAS EXAMINATIONS

The Council has agreed to hold the Primary Fellowship Examination in Khartoum and Colombo in January, 1961, and the Primary F.F.A.R.C.S. Examination in Colombo in the same month.

ANATOMICAL MUSEUM

The museum will be closed during the month of August.

BOOKS ADDED TO THE LIBRARY

April—June 1960

Anaesthesia
WALSH. General anaesthesia for dental surgery.

Anatomy
BOURNE. Structure and function of muscle, vol. 1: Structure.
KROGH. Capillaries. 2nd edition.
LEIGH AND WEEKS. The Mediastinum.
LOCKHART. Living anatomy. 5th edition.

Bacteriology
SNEATH. A study of the genus Chromobacterium. Author's gift.

Biochemistry
PARKES AND SMITH. Recent research in freezing and drying.

Cancer
ARIEL AND PACK. Cancer and allied diseases of infancy and childhood. Gift of Dr. G. T. Pack.
GONZALEZ MARMOL. La Endometriosis. Editor's gift.
MURPHY AND ABBEY. Cancer in families.
SMITHERS. A clinical prospect of the cancer problem.

Cardiology
GOLLAN. Physiology of cardiac surgery.
SELLORS. The contribution of surgery to clinical cardiology (pamphlet).

Chemotherapy
FLOREY. Clinical application of antibiotics, vol. 4: Erythromycin, etc.

Cytology
CAUSEY. The cell of Schwann.

Haematology
MOURANT. The ABO blood groups.

Medicine
DAVIDSON. Principles and practice of medicine. 5th edition.

Neurology
JEFFERSON. Selected papers.

Ophthalmology
ADLER. Physiology of the eye. 3rd edition.
DUKE-ELDER AND PERKINS. Transparency of the cornea.
GALIFRET (editor). Mechanisms of colour discrimination.
TREVOR-ROPER. Lecture notes on ophthalmology.
W.H.O. Ophthalmic aspects of onchocerciasis. Gift of Prof. Arnold Sorsby.

Orthopaedics
SIMON. Principles of bone X-ray diagnosis. Gift of Messrs. Butterworth, publishers.
WILES. Fractures, dislocations, and sprains.

Pathology
DAWKINS AND REES. A biochemical approach to pathology.
DYKE. Recent advances in clinical pathology. 3rd series.
ILLINGWORTH AND DICK. Textbook of surgical pathology. 8th edition.
SMITH. Principles of human pathology.

Physics
GLASSER. Medical physics, vol. 3.

Physiology
BAYLISS. Principles of general physiology. 5th edition, vol. 2.
CAMPBELL AND DICKINSON. Clinical physiology.
FIELD. Handbook of physiology, vol. 1: Neurophysiology.
LIDDELL. The discovery of reflexes.
RODAHL. Bone as a tissue.
VELARDO. Essentials of human reproduction.

Research

FISHER. Design of experiments. 7th edition.

Surgery

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Biography

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The Editor is always glad to receive details of new appointments obtained by Fellows and Members, either through the Hospital Boards or direct.

DIARY FOR AUGUST

Mon.	1		College closed.
Tues.	2		Museum and Library closed this month.
Thur.	4	11.00	Election to Council.
Mon.	22		Clinical Surgery Course begins.

DIARY FOR SEPTEMBER

Mon.	5		Basic Sciences Lectures and Demonstrations begin.
Tues.	6	5.00	Prof. H. ANNAMUNTHODO—Hunterian Lecture—Rectal lymphogranuloma venereum in Jamaica.
Wed.	7		Primary F.D.S. Examination begins. College closed.
Wed.	14		D.C.H. Examination and Second L.D.S. Examination begin.
Thur.	15		Pre-medical Examination begins.
Wed.	21		D.Orth. Examination begins.
Thur.	22		First Membership Examination begins.
Fri,	23		Board of Faculty of Dental Surgery.
Mon.	26		Surgical Lectures and Clinical Conferences begin.
Tues.	27		Final Membership Examination begins.

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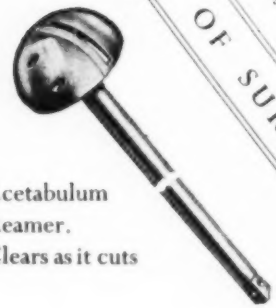

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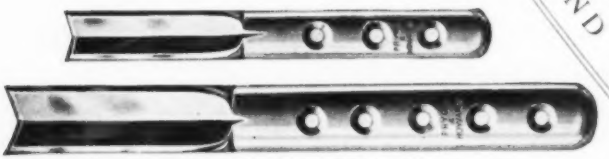

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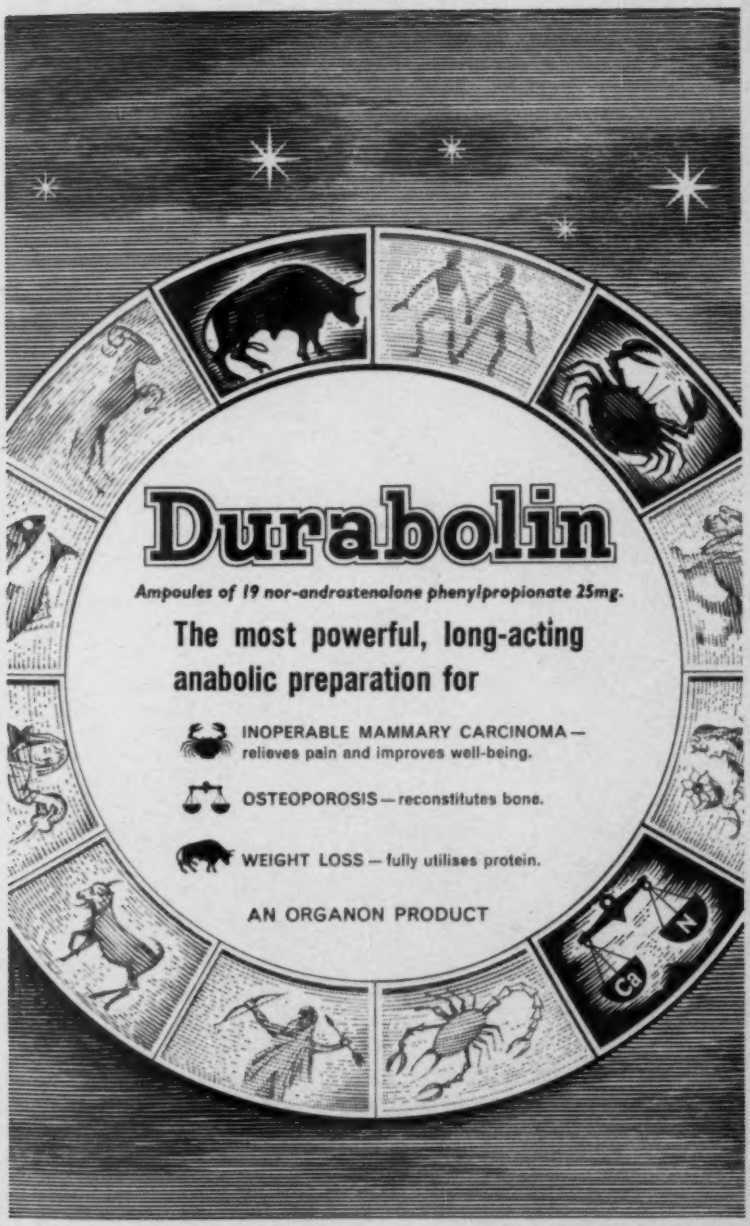
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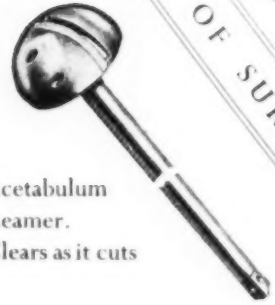

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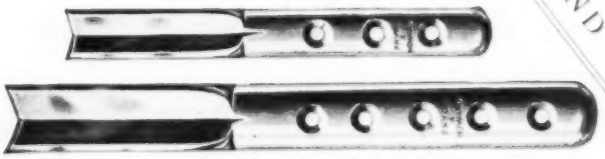

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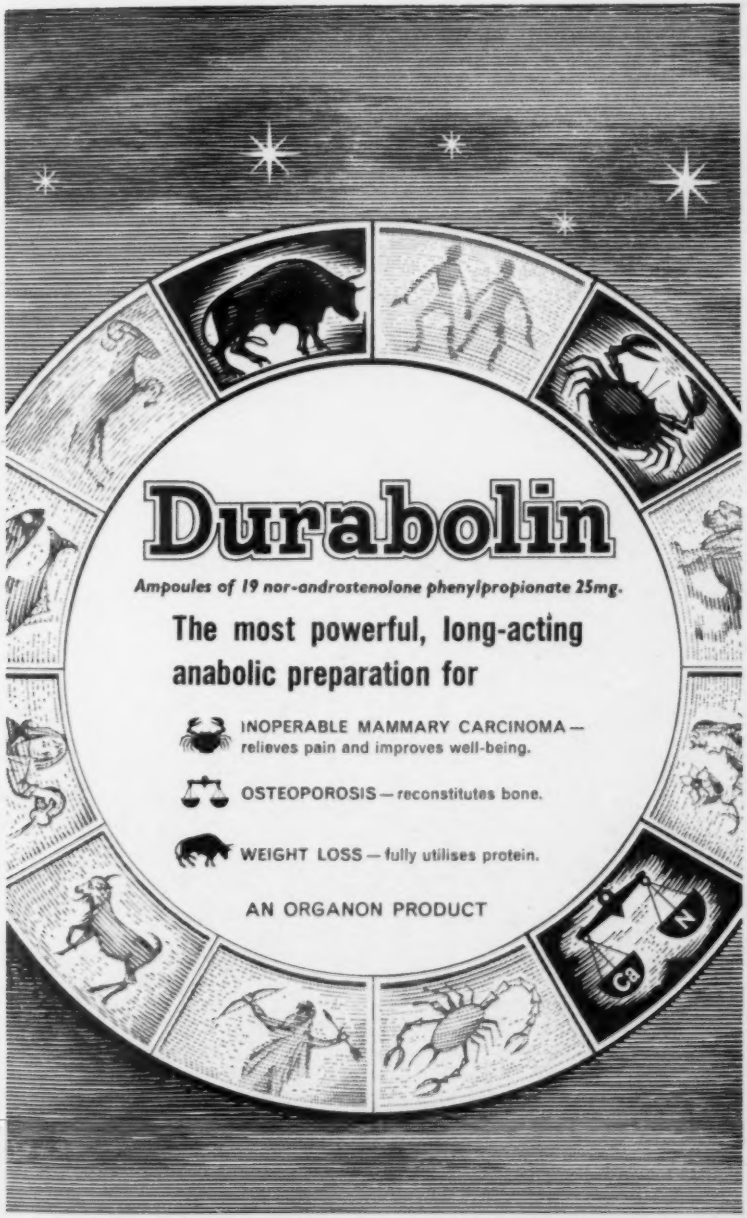
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